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Proper Wiring of Electrical Equipment on Machine Tools

By R. C. Deale

Installing the permanent wiring system — Electrical equipment for machine tools—Use of circuit breakers and fuse switches — Controllers and starting switches

MUCH of the electrical trouble on machine tools may be avoided by correct wiring and protection. If each machine is properly wired at the time it is first installed, or after it has been moved from one location to another, the whole shop will eventually be brought to a high standard without the need of making extensive changes at any one time. The following suggestions will outline the main requirements for a system having a minimum of electrical maintenance troubles.

If wired according to these instructions, machines will comply with the wiring rules of the National Board of Fire Underwriters (National Electric Code) and to the rules of the inspection department of the Associated Factory Mutual Fire Insurance Companies. As most local ordinances duplicate these rules, there should be no trouble with local authorities in connection with machines wired according to these suggestions. There should be a general, comprehensive plan for the whole shop. The feeders should be run to various parts of the shop terminating in suitable steel boxes containing the fused switches for the distributing circuits. These main feeders should be of sufficient capacity to take care of the normal expansion of the equipment in the future. In the case of radical rearrangements or unanticipated growth, the only solution is to add feeders sufficient to meet the demand. But at the outset an attempt should be made to so plan the installation that any additions will naturally follow the course of the original plan. New feeders should not be installed without considering their relation to the system as a whole.

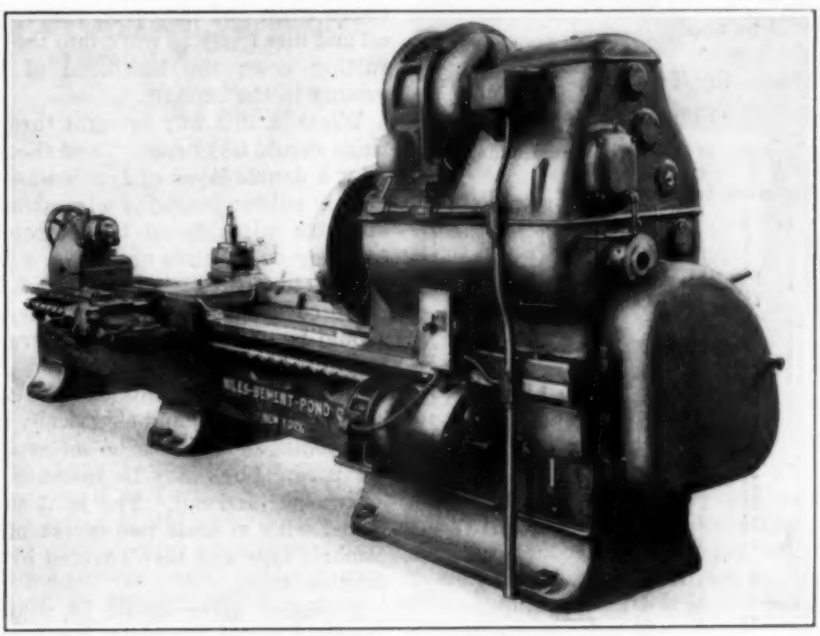


Fig. 1—Electrically operated 27-in. lathe

All wires should be run through some sort of conduit, unless lead-covered cable is used. Rigid conduit should be used wherever possible, but flexible metal conduits are advisable for short runs having several bends. Lead covered cable should be used for underground circuits instead of conduits. All joints should be made with approved fittings. Conduits may be bent to conform with irregular surfaces, but changes in direction should be made by the use of suitable fittings. A conduit system should be installed as a unit, and fastened rigidly in place before the conductors are drawn through it. Long runs should be supported at about 6-ft. intervals by means of appropriate pipe straps, while in the case of shorter runs, enough straps should be used to prevent any movement

of the conduit. The ends of a conduit should be either screwed into a fitting, or fastened to a terminal or pull box by a lock nut and bushing in order to prevent cutting the insulation on the wires.

A typical electrical equipment is illustrated in Fig. 1, which shows a 27-in. lathe driven by the large squirrel cage induction motor shown on top of the headstock, and a rapid power traverse mechanism driven by the small motor mounted at the back of the bed.

The main driving motor is controlled by an automatic resistance-type starter, mounted on the wall or post near the machine, and consequently not shown. The small master switch mounted on the rear of the upper half of the headstock is controlled from the carriage through a spline shaft and gearing. The wires run from this switch and from the motor through the conduit shown and thence under the floor and up again to the control panel. The lines to this panel pass through a fused switch, which makes it possible to disconnect the machine from the line to make repairs. The automatic starter does not provide voltage and overload protection.

The small traverse motor, which runs continuously while the machine is in use, is operated from the small manual starter shown mounted just above the motor. This starter does not provide overload protection.

The newer types of electric motors are furnished with conduit boxes. These should always be used when provided and the conduit anchored in the box with a lock nut and bushing.

Conduit systems should always be grounded. Pipe straps and attachments to terminal boxes will give a reasonably satisfactory ground connection, but a ground clamp with a copper connection to some grounded part, such as the bed of the machine, is always preferable.

The conduit sizes for any given number of conductors should conform to Table I. No conduit smaller than ½-in. nominal size should be used.

Table I—Conduit Sizes for Two and Three-Wire Systems

Size of Wire	Number of Wires in One Conduit								
	1	2	3	4	5	6	7	8	9
	Minimum Size of Conduit in Inches								
14	½	½	½	¾	¾	1	1	1	1
12	½	½	¾	¾	¾	1	1	1	1¼
10	½	¾	¾	1	1	1	1¼	1¼	1¼
8	½	¾	1	1	1	1¼	1¼	1¼	1¼
6	½	1	1¼	1¼	1¼	1½	2	2	2
5	¾	1¼	1¼	1¼	1½	2	2	2	2
4	¾	1¼	1¼	1½	2	2	2	2	2½
3	¾	1¼	1½	1½	2	2	2	2½	2½
2	¾	1¼	1½	1½	2	2	2½	2½	2½
1	¾	1½	1½	2	2	2½	2½	3	3
0	1	1½	2	2	2½	2½	3	3	3
00	1	2	2	2½	2½	3	3	3	3½
000	1	2	2	2½	3	3	3	3½	3½
0,000	1¼	2	2½	2½	3	3	3½	3½	4
200,000 circ. mil.	1¼	2	2½	2½	3	3	3½	3½	4
250,000 circ. mil.	1¼	2½	2½	3	3	3½	..	..	..
300,000 circ. mil.	1¼	2½	3	3	3½	3½	..	..	..
350,000 circ. mil.	1¼	2½	3	3½	3½	4	..	..	..
400,000 circ. mil.	1¼	3	3	3½	4	4	..	..	..
500,000 circ. mil.	1½	3	3	3½	4	4½	..	..	..
600,000 circ. mil.	2	3	3½	4	4½	5	..	..	..
700,000 circ. mil.	2	3½	3½	4½	..	..	..	..	..
800,000 circ. mil.	2	3½	4	4½	..	..	..	..	..
900,000 circ. mil.	2	3½	4	4½	..	..	..	..	..
1,000,000 circ. mil.	2	4	4	5	..	..	..	..	..
1,200,000 circ. mil.	2½	4½	4½	6	..	..	..	..	..
1,400,000 circ. mil.	2½	4½	5	6	..	..	..	..	..
1,500,000 circ. mil.	2½	4½	5	6	..	..	..	..	..
1,600,000 circ. mil.	2½	5	5	6	..	..	..	..	..
1,900,000 circ. mil.	3	5	6	..	..	..	..	..	..
2,000,000 circ. mil.	3	5	6	..	..	..	..	..	..

There are times where it is impossible to make direct conduit connection with a motor or other piece of electrical equipment. In such cases the conduit should be brought as near as possible, terminating in a fitting of the proper type and the wires brought through holes in

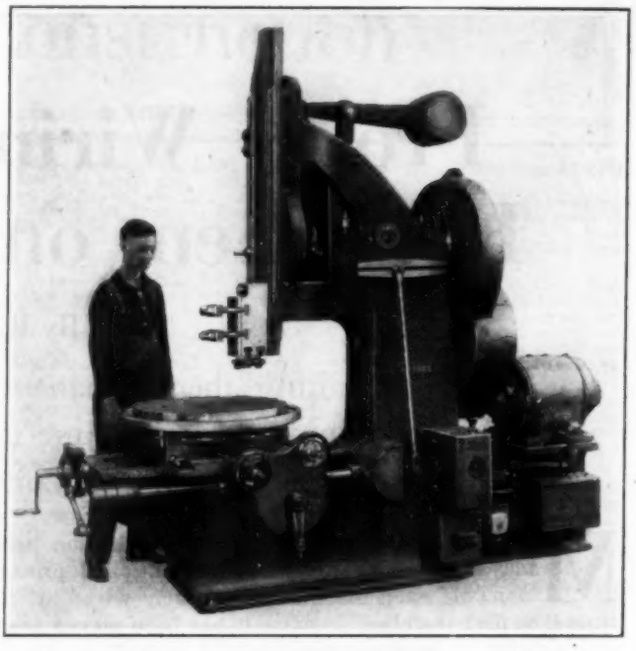


Fig. 2—Slotting machine with electric-motor drive

a porcelain or fiber cover. Porcelain is preferable as a material, but, if blank fiber covers are carried in stock, holes may be drilled to exactly fit the wires to be brought out. This arrangement decreases the number of covers to be carried in stock, makes a better fit between wires and the cover, and decreases the amount of oil and dirt likely to work into the conduit, consequently cutting down the likelihood of the occurrence of a ground in the conduit.

Wires in this way brought through the covers of fittings should be grounded, and the group covered with at least a double layer of friction tape.

Only rubber-insulated wire should be used in conduit, and this wire should be protected by a double-braid covering on all sizes above No. 8 B. & S. Wires in the sizes between Nos. 8 and 14 B. & S. may have a single braid covering. No wires smaller than No. 14 B. & S. should be used except that fixture wire may be used in lighting fixtures.

All splices and joints in conductors should be made both mechanically and electrically secure without solder. The joints should then be soldered together unless lugs are used. Lugs may be fastened together by a screw, lockwasher and nut. The joint so made should be protected with at least two layers of rubber or varnished cambric tape and then covered by a protective layer of friction tape.

Stranded wires should be soldered before they are fastened under clamps or binding screws. Conductors above No. 8 B. & S. in size, whether solid or stranded, should be soldered into lugs for all terminal connections, except where an approved solderless terminal connector is used.

All machines should be wired with copper wire not smaller than that shown in the accompanying tables. Wires carrying current only when the motor is being

started may be one size smaller than that called for by the tables, provided that no wire smaller than No. 14 B. & S. is used.

For control and shunt field circuits No. 14 B. & S. is satisfactory. The sizes are based on carrying capacity only, and consequently should not be used but on relatively short runs. Where the length of the run is more than two hundred feet, and less than five hundred feet, the next larger wire size should be used. On runs over five hundred feet in length, it is always advisable to figure the voltage drop. Tables II, III and IV show the sizes of wire to be used with various horsepowers for 110, 220 and 550 volt direct current lines. Tables V and VI show the sizes for 110- to 550-volt alternating current lines.

Table II—Sizes of Wire for 110 Volt Direct Current

Horsepower	Rubber Insulation, B & S Gauge
3	10
5	6
7½	4
10	2
15	2/0
20	3/0
25	4/0
30	300,000 circ. mil.
35	350,000 circ. mil.
40	500,000 circ. mil.
50	600,000 circ. mil.
60	800,000 circ. mil.
75	1,000,000 circ. mil.
100	1,600,000 circ. mil.

Table III—Sizes of Wire for 220 Volt Direct Current

Horsepower	Rubber Insulation, B & S Gauge
3	14
5	10
7½	8
10	6
15	4
20	2
25	1/0
30	2/0
35	3/0
40	3/0
50	4/0
60	300,000 circ. mil.
75	400,000 circ. mil.
100	600,000 circ. mil.

Table IV—Sizes of Wire for 550 Volt Direct Current

Horsepower	Rubber Insulation, B & S Gauge
3	14
5	14
7½	14
10	12
15	10
20	8
25	6
30	5
35	4
40	4
50	2
60	1/0
75	2/0
100	200,000 circ. mil.

All wiring should be arranged to make it possible to remove a controller or other piece of apparatus simply by disconnecting the wires and conduits dealing to it.

If all wire terminals are marked, there is less chance of a piece of equipment being improperly connected. There is a type of metallic tag, adapted to wrapping around the wire, that is very satisfactory, since wires having these tags may be pulled through conduits with little danger of pulling off the tags. Where wires end in heavy lugs, the identification number is usually stamped on the lug.

Pipe straps should not be used to hold wires unless the wires pass through a porcelain or fiber bushing that is in turn held by the pipe strap.

Each machine should have an inclosed and fused switch, preferably of the safety type, or else have a circuit breaker to protect the machine as a whole. This should be set so as to open the circuit during a sustained overload of 25 per cent. This switch or circuit breaker should be located in a convenient position, so that the operator will be sure to shut off the power when he is finished with the machine. A circuit breaker, while having a higher initial cost than a fused switch, will save its cost in a few months if there is any tendency to blow fuses. The use of the circuit breaker saves not only the cost of the fuse, but also the time of the electrician in replacing the fuse, and it cuts down materially on the idle time of the machine. Usually it takes at least five minutes, and quite often longer, to replace a fuse. A circuit breaker, if properly set and locked, will give all the protection of a fuse and also have the advantage of being easily reclosed.

An electrically-equipped 12-in. slotter is shown at Fig. 2. It is driven by a direct-current, variable-speed motor, that is in turn started, stopped and varied in speed by a drum controller. The controller, with its starting and dynamic-braking resistors, as well as its fused safety switch, is shown mounted on the machine. The equipment is of a type not well adapted for conduit connection, so that the conduits could not be carried into the controller and resistor boxes as is preferable.

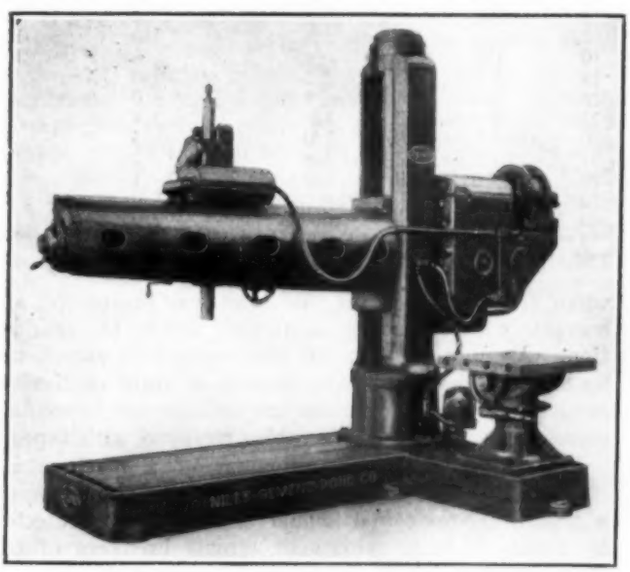


Fig. 3—Radial drill showing conduits on moving parts

A radial drill is shown at Fig. 3. It is provided with a slip-ring main driving motor and a series clamping motor. The driving-motor control is so arranged that it can be operated either from the head or from the gear box. The controller at the back of the head is clearly shown, but the second controller is behind the

machine. The two controllers are interlocked electrically so that it is impossible to produce a short circuit by improper operation of the controllers. The small series motor is operated by a reversing-drum controller, also not shown. The line switches and the fuses for the two motors are mounted on a wall or column near the machine, and consequently are not shown. This figure shows what can be accomplished in wiring a machine

Table V—Sizes of Wire for 110, 220, 440 and 550 Volt, Two-Phase, Alternating Current

	Sizes of Wire, Rubber Insulation			
Horsepower	110 Volts	220 Volts	440 Volts	550 Volt.
3	8	14	14	14
5	6	10	14	14
7½	3	8	12	14
10	1	6	10	12
15	2/0	4	8	10
20	3/0	2	6	8
25	4/0	1/0	5	6
30	300,000 circ. mil.	2/0	4	5
35	350,000 circ. mil.	2/0	3	4
40	500,000 circ. mil.	3/0	2	4
50	600,000 circ. mil.	4/0	1/0	2
60	800,000 circ. mil.	300,000 circ. mil.	1/0	1
75	1,000,000 circ. mil.	400,000 circ. mil.	3/0	1/0
100	1,500,000 circ. mil.	600,000 circ. mil.	4/0	3/0

Table VI—Sizes of Wire for 110, 220, 440 and 550 Volts, Three-Phase, Alternating Current

	Sizes of Wire, Rubber Insulation			
Horsepower	110 Volts	220 Volts	440 Volts	550 Volts
3	8	12	14	14
5	4	8	14	14
7½	2	6	10	12
10	1/0	6	8	10
15	3/0	3	8	8
20	3/0	1	6	6
25	300,000 circ. mil.	1/0	4	5
30	350,000 circ. mil.	2/0	3	4
35	400,000 circ. mil.	3/0	2	4
40	500,000 circ. mil.	4/0	1	3
50	700,000 circ. mil.	350,000 circ. mil.	1/0	1
60	900,000 circ. mil.	350,000 circ. mil.	2/0	1/0
75	1,200,000 circ. mil.	500,000 circ. mil.	4/0	2/0
100	1,900,000 circ. mil.	700,000 circ. mil.	250,000 circ. mil.	4/0

when the parts bearing the electrical equipment are movable with respect to each other and to the foundation. As may be seen, all the conductors except the leads from the motor are carried in rigid or flexible conduits. Since the motors are not adapted to conduit connections, the leads are cables wrapped with tape.

Where the electrical equipment of a machine includes more than one motor, each motor should be on a separate circuit and should be separately protected by fuses, thermal cutouts or circuit breakers of the proper rating for the motor to be protected.

Controllers should be completely enclosed. If they are exposed to unusual conditions because of dust or dirt, the controllers should have dust-proof covers. The cases of all controllers should be grounded, preferably by a wire connected to a water pipe, the frame of the building or some other permanent ground. Standard lighting snap switches should not be used for starting motors larger than one-fourth horsepower. There are a number of switches on the market especially designed for motor starting, and the use of one of these switches is preferable.

If these suggestions are followed, and if the electrician adheres to the standard practice for the details, electrical equipment troubles will be reduced to a minimum.

Standardization for Drafting and Graphic Presentation

Circulars recently prepared by the American Engineering Standards Committee announce the appointment of committees for the standardization of methods of graphic presentation. The importance of the work can scarcely be overestimated.

Graphic presentation of statistical and quantitative data belonging to the most varied fields of human endeavor, has made great progress, particularly during the last decade. Charts, diagrams or graphs put life into the dullest of statistics and make the facts "stick out." They have their usefulness in all fields, and usually there is a best way of drawing them that should become the "standard."

Many large organizations have prepared their own manuals of drafting practice. It seems very desirable to compare notes and to get the consensus of opinion of competent judges in order to lay down the basic ideas and rules to be followed by those who are engaged in the preparation of charts and drawings. What is needed now is to come to a definite understanding as to the best practice to be recommended as a national standard.

The Value of Basic Research

The value of basic research, aimed at the acquisition of knowledge without immediate utilitarian objectives, is emphasized in the recent report of the visiting committee of the Bureau of Standards. The committee expressed the belief that such work should be undertaken by the bureau to a greater extent than has been done in recent years.

"The history of civilization is filled with illustrations of the utilization for the good of humanity of the results of scientific work, undertaken without reference to its direct value and often remaining unused long after its first announcement," the report states. Illustrations given are the electrical industry, radio, the vacuum tube, X-rays and radium. In each case the fundamental discoveries that made invention possible were made without thought of possible utility. Similarly, the present-day study of atomic physics is cited as a line of research that is likely to yield results of vast proportions in the future.

The report also calls attention to the value of industrial research. Numerous examples of savings effected by such research at the Bureau of Standards are given. Studies of certain problems pertaining to the automobile industry are cited, the combined result of which is a saving of $155,000,000 per year to the American public.

Both types of research, the committee believes, are essential to the welfare and industrial prosperity of the nation. The economies resulting from them are often very considerable, and are necessary if America is to maintain its present high wage rates and high standards of living in the era of intense industrial competition upon which the world now appears to be entering.

The desirability of having research conducted by a national institution is emphasized. Its value depends on the extent to which the results are utilized rather than upon the cost of the work, and a national laboratory such as the Bureau of Standards can afford to give its results freely to all who can profit by them, whereas a private laboratory cannot always be expected to do so.

John Dick Investigates Reclamation

By F. M. A'Hearn

Bill Weston preaches moderation in all things—Too much reclamation is no saving—Modern equipment is often used beyond the degree of moderation

JOHN DICK had a birthday. Nothing unusual, perhaps, all honest machinists have birthdays more or less frequently. This particular birthday, however, was really an event. Mrs. Dick had carefully planned the affair, a surprise dinner for John and a few friends. Among the guests were Bill Weston, master mechanic of the Coaltown and Great Western R.R. at Coaltown, and Jim Kelly, the machine tool man. The affair was a success and "A pleasant evening was spent with the notables of Woodland gathered to honor their substantial citizen, the head of the Dick Pump Works," —quoting the *Woodland Evening Star.*

After the departure of the local guests Dick, Weston, and Kelly must, of necessity, have a few words together before retiring. These three men who were apprentices together in the Dick Pump Works under the management of John Dick, Sr., usually require a goodly amount of time to have a few words together. From a common start each has been successful in his own field. Their lines of activity being somewhat divergent, conflicting opinions are bound to arise. This meeting was no exception.

Convincing One Who Is "Sot" in His Ways

Kelly, while knowing Weston to be progressive, has observed that Bill is decidedly stubborn in adopting a new practice without thoroughly understanding why he does so. Until convinced, Bill is, as Kelly says, "Rather 'sot' in his ways." Weston is a firm believer in conservation of material and time, insisting, however, on orderly shop surroundings. Some rather extreme statements concerning waste of materials in railway shops were made at a railway club meeting. At the same time the savings effected by a well organized reclamation plant were pointed out. Weston's rather pointed criticisms on the subject as expressed in the meeting have been related to Kelly, who in turn has suggested to John Dick that he bring up the topic with Bill.

"Jim," said John, when the three were alone, "I have been reading some interesting descriptions of what railway shops are accomplishing in the way of reclaiming materials. In your work you probably see some of the progress that is being made. Tell us about it."

"Well, John," said Jim, "some of the shops have really accomplished wonders. It is surprising the amount, as well as the diversified kinds of materials, that the reclamation plants are taking from the scrap and putting back into stock." "Bill," said John, with a sly wink at Kelly, "We never looked over the reclamation plant at Coaltown. What are you doing?

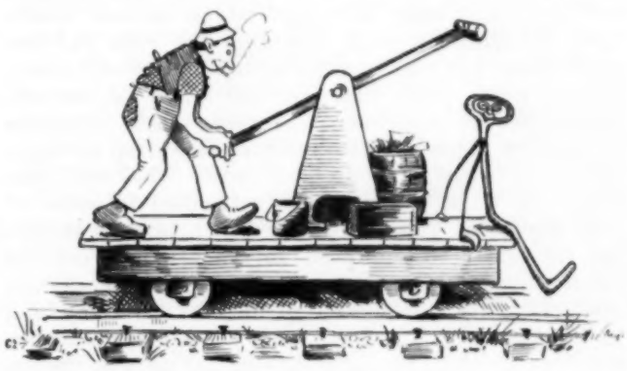
"Hmm," answered Weston, "Reclamation, hey? How about the Dick Pump Works? What are you doing, John?"

"Don't know as we have much to reclaim in our shop," was John's answer.

"That so? Well why in thunder don't you teach your help to throw all kinds of good materials into the scrap bin or under the shop, then hire a force of men to pick them out and hand them back to you and you will have the soil prepared for a first-class reclamation system. Once started, the plant, like all quick-growing varieties described in the seed catalogues, will thrive with scarcely any attention whatever."

"Do I understand, Bill," asked John, "that you are not a believer in conservation of supplies?"

"If you do, John, you are about to have a misunderstanding corrected," replied Bill. "We have a scrap dock at Coaltown where our scrap is sorted and classified. We have a few necessary tools at the scrap dock where certain materials are repaired and made usable, rather than to transfer them to the main shop for repairs. Section hands pick up materials along the right of way; everything gathered is shipped in with the scrap. In case a serviceable fire hook should fall from a locomotive tender en route, the fact that this fire hook is forwarded to Coaltown in a car of mixed material does not imply that it's journey has contaminated it's reputation or that it becomes scrap.



The self-respecting fire hook

I maintain that this fire hook is still a fire hook and fit to associate with all the other members of the fire hook tribe. If it has been bent, it can be straightened and sent to the stock rack for far less cost than it will involve to carry it to the blacksmith shop. That fire hook may be called reclaimed material, but my imagination does not extend that far. My own opinion is that instead of inventing a new name for an every-day act,

I should exercise my wits, or those of some of my fellow workers, to see that fire hooks do not fall from tenders. First, it is a dangerous condition of affairs. Second, it requires a large floating supply of fire tools if they are to spend part of their more or less useful lives as a feature of the landscape along the right of way. So much for that. It has been said that dirt is only matter misplaced. Very good. If this is true, a large percentage of so-called scrap is no more or less than misplaced material. I would consider that a piece of material that is no longer fit for the purpose for which it was first made, but which is worked over into some other serviceable piece, probably as good as if made of new stock, may be termed reclaimed.

"You men are both mechanics. Suppose you have a broken chisel that needs dressing. You lay it aside and use another one, forgetting that you still have the first one. Later, in overhauling your kit, you find chisel No. 1. You get it dressed, you grind it, and put it back in your locker. You may dignify the process by calling it reclamation, or again, you may call yourself a careless workman for keeping useless tools hoarded away. The latter definition would have been applied by John Dick, Sr., and if the incident occurred too often it might be emphasized. Remember how he used to look over the tools at the lathes and planers? Ask if you were not on speaking terms with the tool dresser or were you afraid the grindstone would bite you? As we look back we can remember that John, Sr., did not have much capital tied up in idle tools or inactive materials accounts.

Reclamation Plant at the Pump Works

"You, John, for example, might allow customs in your shop that do not now exist. If a workman wanting a two-foot piece of pipe takes a full length and cuts off one end, he saves himself cutting one thread. We were taught, however, to thread the unused piece and place it back in the rack, but let's forget what we were taught. Say one workman cuts off one end of the pipe leaving the remainder unthreaded, and another workman does likewise with the other end. We now have a piece of unserviceable pipe until it is threaded. Say a third workman casts aside this pipe, taking another length from the stock to avoid threading the ends the two other fellows left. Do the same with your pattern lumber; a new plank each time an odd piece is wanted. Accumulate an assortment of broken flasks alongside the foundry. Throw all your machine shop scrap and turnings in a corner of your shop yard. That will give you a start that will be readily followed by some of your workmen. You may now put men to work threading the odd pieces of pipe, gather and sort out the pattern lumber, have the broken flasks repaired, dig the small scrap and turnings out of the back yard, and total up the results. Of course, you will have saved money and may extend your activities as far as you choose, or on the other hand you may go after the root of the thing and have reasonable care exercised in the use of your property.

"Of course you may say that the conditions I have mentioned are not going to exist in your shop. Certainly not if you expect to continue in business, but small shops do sometimes fall into such ruts. Unless a firm hand guides them out again the next chapter in their history will feature a sheriff sale with the possibility of the plant being bought and junked by a live competitor. What caused me to rise on my hind legs and declare myself at that club meeting was that a surprising amount of the alleged reclaimed material simply belonged in the lost and found column. The talk also indicated to me that someone was patting himself on the back when he should have been applying a foot where it would do the most good. I further decided that some certain person or persons connected with the speaker's road handled materials, as well as truth, rather carelessly. He implied in his talk that his road was a shining example and apparently judged the other roads by using the reclamation plant as a unit of measure.

"One of the landscape gardeners assisting section foreman Flynn in beautifying the right of way by keeping the track surfaced, may break a shovel handle. Flynn has no shovel handles, neither has he suitable tools for applying them. He puts the shovel away. Later he sends the shovel, a few worn-out track chisels, and some other material picked up along the right of way to the shops. The material all arrives at the Scrap Dock. We could have a blacksmith remove the rivets in the shovel handle, a carpenter fit a new handle and bore rivet holes, and the smith make new rivets and apply them. Someone would carry the shovel from place to place in order to get all this done. Probably a new shovel would cost less money. On the other hand, an intelligent handy man at the scrap dock can put in handles and deliver to the storehouse repaired shovels, not reclaimed ones. While this is going on let's not forget to check up occasionally on how many shovels are being sent out. Flynn must see that tools are properly cared for and breakage avoided. He can save more money that way than we can in making repairs. In other words, don't pat yourself on the back when you should be jolting Flynn into line. The track hands are not in our department, but the example is the same whether applied to a track foreman or a roundhouse foreman. Fact is, I believe, that the shop foreman becomes the worst offender. It is possible for him to become negligent in the care of material, knowing that the scrap dock or reclamation men will sort out the usable parts and you would be surprised to know how much small material he can furnish them.

Unused Material Is Not Scrap

"When Jackson, the scrap dock foreman, showed me a large quantity of bolts, nuts, rivets, and similar materials that he had sorted from the scrap, he was rather elated to think of what he had saved. He told me the bolts were 'good as new.' Fellows, it was worse than that, they *were* new. Each and every bolt had been re-threaded, each nut re-tapped. Investigation disclosed that a new bolt would come in with the nut screwed on the end just as it came from the stock. Those nuts were all removed and the re-threading operations solemnly carried out as earnestly as if they amounted to a whoop when completed. I traced back to his source of supply and showed those responsible the error of their ways. At first they seemed inclined to think that the practice of returning all such unused material to stock by way of the scrap box was quite all right. I differed and hinted that a live foreman who handled his job properly would not allow good material to be scattered around where the sweepers would gather it up with the scrap. Also made it plain that a big part of a foreman's job was in knowing how much material was really needed in performing certain work. I pointed out that a man who wasted material

was worse than a loafer. We have discontinued the circulating system. You know if a nut is re-tapped a few times it is going to become larger and may wear out from re-tapping instead of from legitimate use. Anyhow, aside from the work at the scrap dock, it costs money to haul material back and forth for no purpose whatever, and a certain amount is bound to be lost. The best way is to insist on intelligent ordering and renewals of parts.

Moderation in All Things a Good Rule

"I sometimes think that we railroad men hang off a long while before taking up some new method. It is also readily noticeable that in many cases when a new method or process is introduced it is, to use slang, 'Rode to Death.' You remember when compressed-air tools first came into use in shops, once the compressor and reservoir were installed, an unbelievable number of uses were discovered for compressed air. Some were labor saving and have been developed in the very useful line of compressed-air tools and appliances that are so commonly used in all shops.

"Other schemes were tried out that effected no saving in time or money, at least not worthy of serious consideration. Let me illustrate. One shop that I remember had a number of covered pits in the shop floor, the covers being hinged on one side. Some ingenious schemer gathered together air cylinders and

The compressed-air trap door

placed them in the pits to open and close the doors or covers when necessary to do so. Compressed air was used for numerous other purposes equally as wasteful as the door opening and closing apparatus. Lines were run at random through all sorts of places and with slight regard for secure fastening or careful tests for leakage. Well, to make a long story short, by the time that shop was rightly equipped with the necessary amount of drills, air hammers, and similar labor-saving tools, it was found that the compressor capacity was not sufficient to maintain the required pressure in the shop lines. Investigation disclosed that many extemporized devices were poorly constructed and when used were decidedly wasteful in air consumption. Further investigation disclosed innumerable leaks in some of the temporary pipe lines that had been installed. Discontinuing the novelty uses for compressed air, tearing out numerous poorly constructed lines, and going over the remainder carefully with a view of stopping all leaks, brought out the information that the compressor would maintain an ample amount of air for the necessary shop tools when operated at less than 75 per cent of its capacity.

"I would say that the old rule 'Moderation in all things a good rule,' could be readily applied. To get down to what might be truthfully called reclaiming of material, that is, taking a piece of material that is no longer usable for its original purpose, and re-fashioning it for some other purpose, I am a strong believer. At the same time a man should approach this task in a manner similar to that used in making the acquaintance of a strange mule. Look the situation over and consider the possible consequences before you act. There are so many factors that enter into reclaiming that it is sometimes more expensive than no salvaging at all. It would be useless to convert scrap into something for which the material is not fitted, and when it is not going to stand up in service.

"An example of this point may be found in a shop where I noticed a foreman cutting down driving axles to serve as crankpins. He was going to use the wheel-fit ends that very often fail in service. We have taken axles similar to the one that I saw being made into crankpins and by cutting into them discovered that a fracture existed, which would readily escape detection. It leads me to believe that the wheel-fit ends are not suitable for crankpins—another case where a money-saving idea may easily be carried to extremes. For this reason, we reclaim only that part of the material that we feel is safe and suitable for service.

Bill Is Hard to Convince

"Fellows," said Bill, "I admit that I am hard to convince. I don't care to be classed as a back number, neither am I trying to condemn modern methods and practices by alleging they are not as good as our methods in the good old days. None of us three men are following out all the practices taught us as apprentices. Modern progress has decreed that we must abandon some of those practices. Later discoveries and improved machine tools have made it possible for one man to do in a day what would have taken him a week or more when we were youngsters. I believe we are all trying to keep abreast of the movement of American progress and are succeeding at least as well as the average. I fail to see, however, why I should be justified in grasping every new development or method and trying to apply it as a general cure-all for the numerous complaints that arise in the upkeep of railway equipment. Our improved methods and convenient shop equipments should be used judiciously and intelligently, but not used in such a manner that our standards of workmanship shall be lowered by their use. If you, John, were to allow clear pattern lumber, reamers, or small tools and supplies to be scattered all over your plant, or if I allow every surface of a locomotive that will afford a resting place for small materials such as nuts, bolts, rivets, washers, cotters, and pipe fittings, to be littered with this material, and then if either or both of us become indignant and send men to gather this material up and restore it to its proper place, I don't believe we are reclaiming, but I do believe that we are doing poor jobs of housekeeping in permitting such practices. I may again state that I am in favor of reclaiming, but not when it is carried to such an extent that men will depend upon reclamation methods as an excuse for waste of valuable material."

The Nuisance of Machinery Vibration to Neighbors

By Leslie Childs

IT GOES without saying, that where heavy machinery is operated in a factory, due regard must be had for the rights of adjacent tenants or owners in respect to the enjoyment and use of their property. If, then, machinery of this kind is operated in such a manner as to seriously hinder the adjacent owners in the use of their premises, these owners have a right of action to enjoin the continued use.

Of course each case of this kind must necessarily be decided in the light of its surrounding circumstances which precludes the statement of a general rule. However, as an example of judicial reasoning on this subject, the recent New Jersey case of Wallace & Tiernan Co., vs. United States Cutlery Co., 128 Atl. 872, is well worth a brief review by factory owners, operators and executives in general. In this case the plaintiff was engaged in the manufacture of chlorine gas distributing machines, meters, gages, and other scientific devices. He also conducted an experimental laboratory in which delicately adjusted appliances were used, and a drafting room for the drawing of plans incident to its business.

The plaintiff's plant was located, in a factory district, about 250 feet from the plant of the defendant. The latter, it appears, operated a high-speed uniflow engine and generator to generate electric power for his plant, which, owing to vibration, seriously interfered with the complainant's business. This vibration, the evidence showed, shook the walls of the plaintiff's mill in such a manner as to affect noticeably the entire building, and thus hampered the department heads and their assistants in their work. In this situation the plaintiff brought the instant action in which he sought to enjoin the defendant from the operation of his generator as outlined above.

Factory District No Excuse

In answer to this action the defendant, among other things, took the position that the plaintiff had no right to attempt to carry on his business, in view of its character, in a factory district; that he should isolate the plant, and that if he attempted to operate in a factory district he should assume all risk of disturbance. In other words, that the noise and vibrations should be considered as incident to the district, and if the plaintiff was injured thereby he should seek a remedy by moving to a quieter neighborhood, or by constructing a building that would insure the desired atmosphere.

Upon the trial of the cause a decree was rendered in favor of the plaintiff. From this the defendant prosecuted an appeal to the higher court and here, after a review of the evidence as outlined above, the court, in part, said:

"The law guards jealously, for all alike, the enjoyment of all private property. The extent of the right of enjoyment may vary, but not the rule of protection. The right of enjoyment is surrendered in a factory district only to the extent of the inconvenience incident to the character of the business carried on there, no more. To be forced to suffer more is actionable.

"The ceaseless pounding of the vibrations from the defendant's engine against the walls of the plaintiff's mill is not incident to the neighborhood. The same annoyance would happen, under the same conditions, if both factories were on a farm. Before the defendant's power generating engine was installed there was no such disturbance, and it was then a factory district. Remove it, and you still have a factory district without sensible vibration. It was not a neighborhood hazard to be anticipated, and is not one to be suffered. No other factory emits such disturbing vibrations. Community vibrations must be endured, but vibrating a community is a nuisance. * * *"

But, the defendant interposed, no other factory or neighbor had made complaint of the operation of the engine, further, it was claimed that since the engine complained of was of a standard type, and mounted on a foundation of approved construction, the plaintiff was in no position to demand relief. In answer to these contentions the court, among other things, said:

"That no other mill owner or neighbor has complained is beside the question. The vibration causes special injury to the complainant's business and property, and, though others may suffer uncomplainingly, the plaintiff is not obliged to. * * *

"It is not an answer that the defendant's engine is of approved construction. This is not a negligence case. It is enough that the engine causes the injury. That the vibrations are more particularly directed toward the plaintiff's plant than elsewhere, due possibly to earth formation, is not the plaintiff's fault. Besides, the infliction of the injury is entirely unnecessary, because it can be easily avoided by insulating the foundation; this can be done at a moderate cost. * * *"

The Decision of the Court

In conclusion, the court granted the injunction prayed for with orders that the defendant should be given a reasonable time to remedy the condition. Holding, as outlined in the opinion, that despite the location of the engine in a factory district, the defendant had no right to operate in such a manner that its vibrations interfered with the plaintiff's business, even though that business was of a delicate nature and required a certain degree of quietude.

The foregoing New Jersey case was well considered, and in view of its facts and holding constitutes a decision of force and value on the question involved. And, in the light of this holding, it is obvious that considerable care should be used in the installation of heavy machinery that is bound to give off a certain amount of vibration, in respect to its effect on adjacent owners. For, as held in the case reviewed, if such vibrations materially interfere with the operation of a neighboring plant, the latter may acquire a right to action to enjoin that will be enforced. The case reviewed is one that every factory owner, operator and executive may with profit have in mind when machinery, that by any possible chance may prove offensive to neighboring plants, is being installed.

Care is not a very costly quality, but carelessness may have rather disastrous results. It is better to forestall such "come-backs" as found in the above case, than to have to spend a great deal of money and to lose an equal amount of time in setting something to rights that might have been properly cared for in the beginning. Cases such as this are frequently met in engineering practice.

Automotive Production

Building McCormick-Deering Tractors

Special Correspondence

How certain engine parts are machined—Replaceable hard-iron sleeves used in cylinders—Engines assembled in horizontal position—Assembly of tractors

THE pistons, which are of gray iron, are turned and ground in a manner that has practically become standard in automotive work. The most interesting operation is that of rough turning, which is performed in a four-spindle vertical machine, shown in Fig. 7. The piece is turned; the end is faced and the grooves are cut simultaneously. The turning tool starts downward first, and as soon as it is well out of the way the facing tool starts. Then, when the turning tool is far enough down to clear, the grooving tools start feeding in. The spindles operate independently, which allows the operator to stop and load them in rotation, as evidenced by the different stages to which the machining has progressed on the pistons shown in the illustration. The pistons are balanced and machined so that they are all within an ounce of the same weight. The same is true of the connecting rods, which are not only balanced for weight, but are also balanced for center of gravity over a knife edge. The result is that any piston or connecting rod bought as a repair part will be within an ounce of the weight of the parts that were originally in the engine.

Sleeves are used in the cylinders—a type of construction that makes possible the use of a hard, close-grained iron of special analysis. Such iron wears longer than the softer irons. The use of sleeves permits the replacement of a worn or scored cylinder without trouble or delay, and without removing the engine from the tractor. The trouble due to distortion of the sleeves, which has been encountered more or less by some users of sleeves, has been eliminated by having ribs of the proper size and thickness cast in the engine block to prevent the setting up of strains when the cylinder head is bolted to the block. The sleeves are first turned on the end and under the flange, and the flange is turned and faced as shown so that the pieces will fit in the fixtures on the boring machine shown in Fig. 8. Here they are rough and semi-finish bored by bars that carry two sets of cutters each and are piloted at the bottom so that the cuts will be straight. The sleeves are locked in the fixture by a cam-action top plate controlled by the handle shown at the right side of the boring bars. From 280 to 300 sleeves per day are machined in this machine and are then passed to a 4-spindle horizontal machine for the final boring.

The machine shown in Fig. 9 is finishing the top, bottom and both flat and angular surfaces on the side of each of the crankcases clamped to the table of the machine. There are six roughing and three large, inserted-tooth finishing cutters in operation at the same time, the roughing cutters being located on the "near" side of the machine, as shown in the illustration, and the finishing cutters operating on the side from which the cylinders emerge. Seven cases are placed on the table at a setting, and are locked in position by hinged bars over the top, each bar being forked at the end opposite the hinge to receive a hinge-bolt and carrying two bolts that can be adjusted to lock the cylinders tightly in position.

Quantity Production in Milling Operation

The next operation is that of milling the ends, which is done on the same type of machine as that described above, and then the cases pass, via a roller conveyor, to the Foot-Burte machine shown in Fig. 10. Here each case in turn is locked into the machine shown and the crank and cam bearing holes are rough bored. The large bar at the left end of the machine carries two sets of roughing cutters that take out approximately $\frac{1}{8}$ in. on a side, working to a tolerance of from 0.002 to 0.004 in. There are two of the machines and each machines 84 pieces per day—a total of 168 pieces.

The bolt-circles in the ends of the crankcases are drilled and tapped in the Greenlee machines shown in Fig. 11. One machine drills 15 holes in one end of the case and 17 holes in the other end, and the other machine taps the holes. All holes are drilled in the one machine and tapped in the other simultaneously, the heads that carry the spindles feeding in until the proper depth is reached and then reversing automatically. Two more machines, of similar type, drill and tap the tops and bottom of the cases. The four

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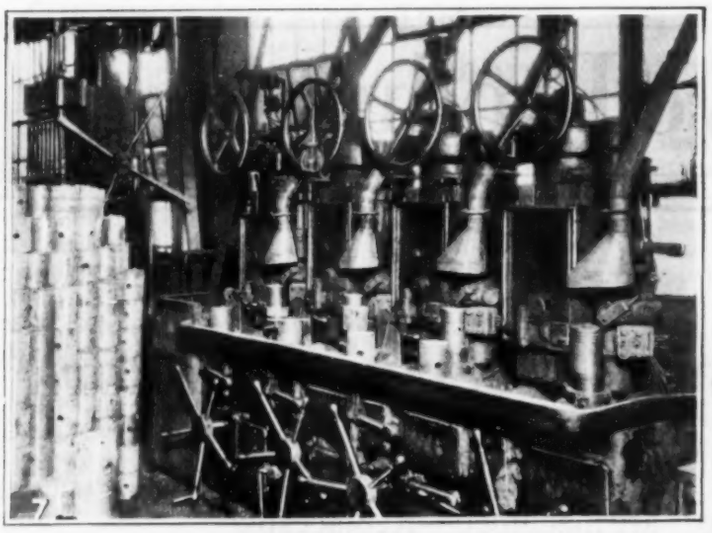
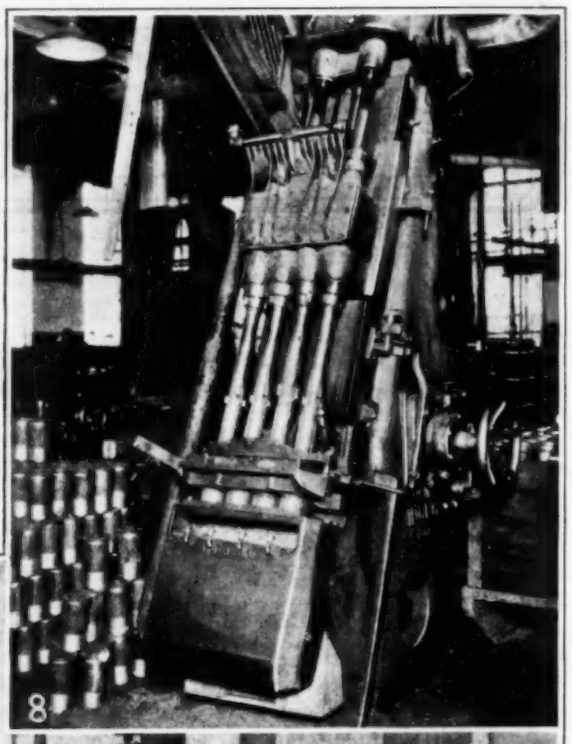
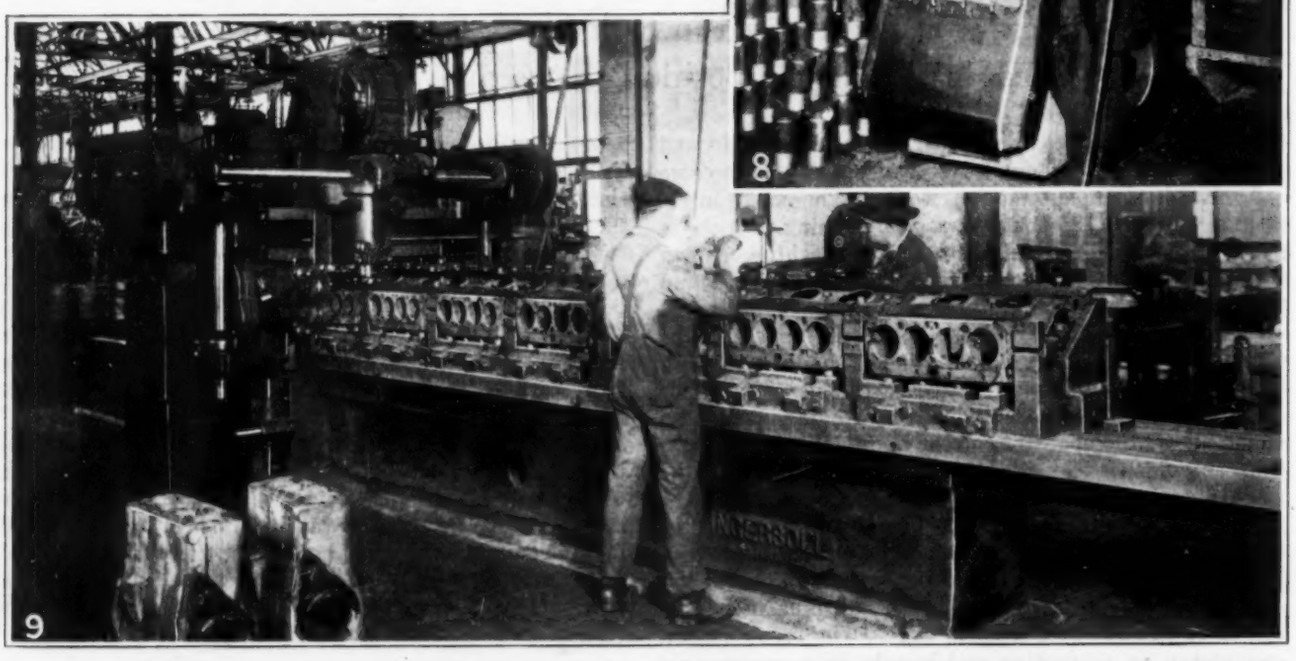






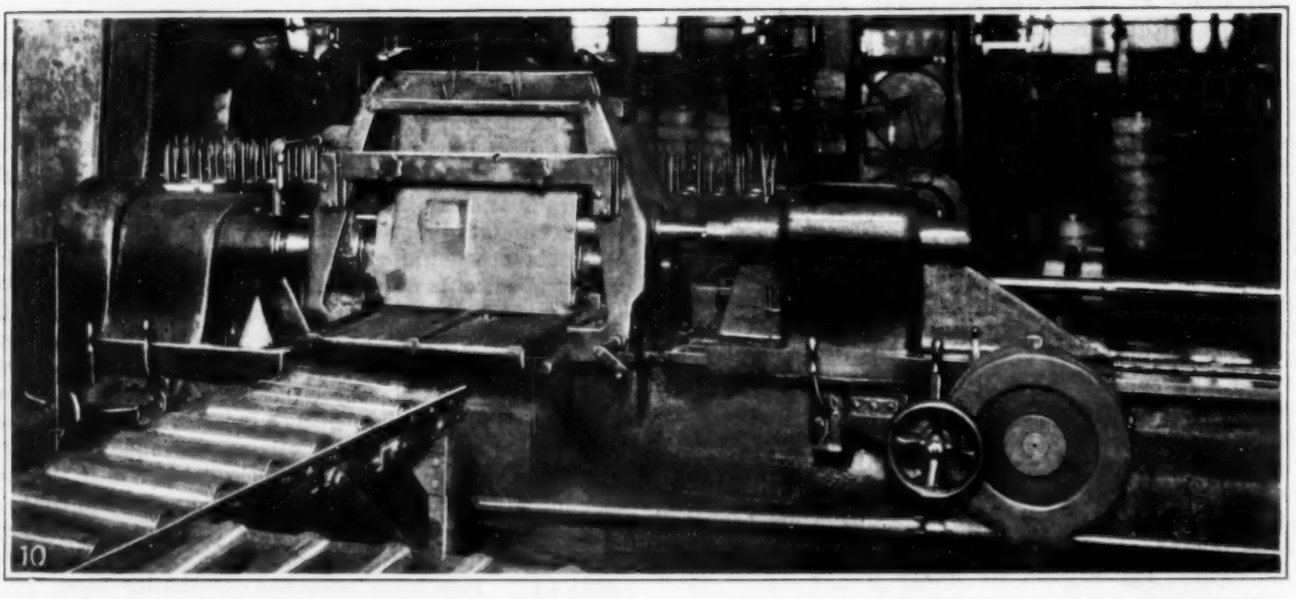
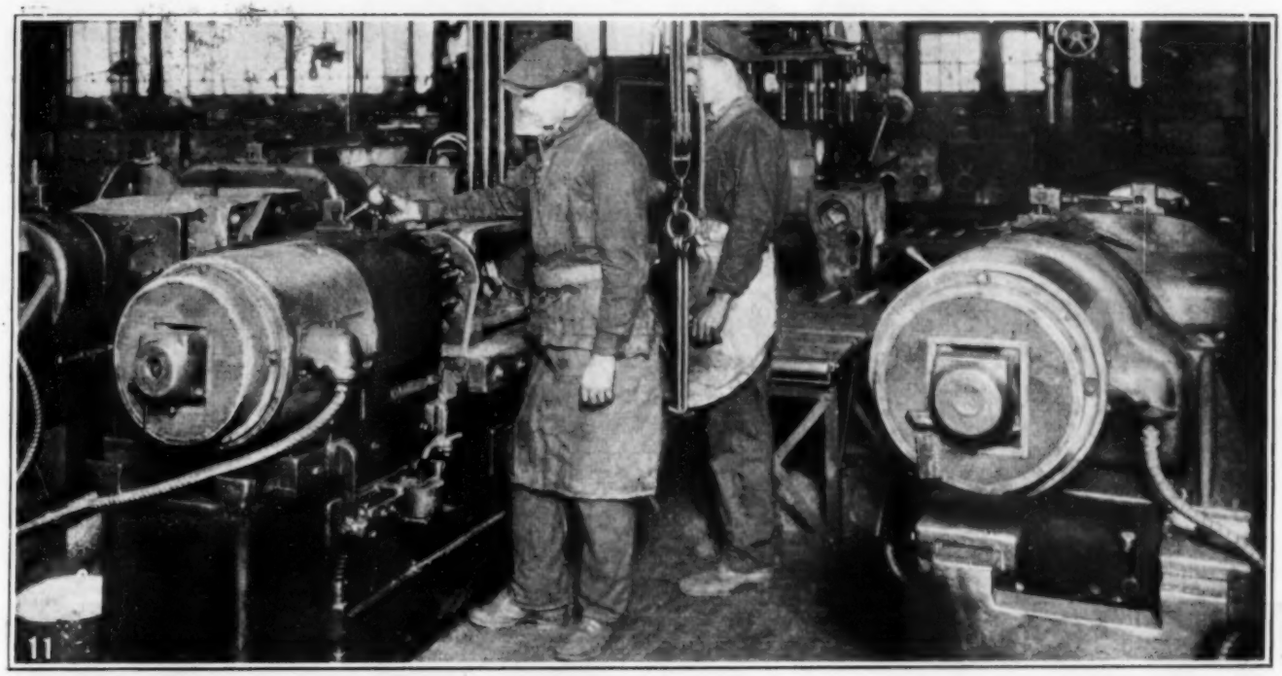
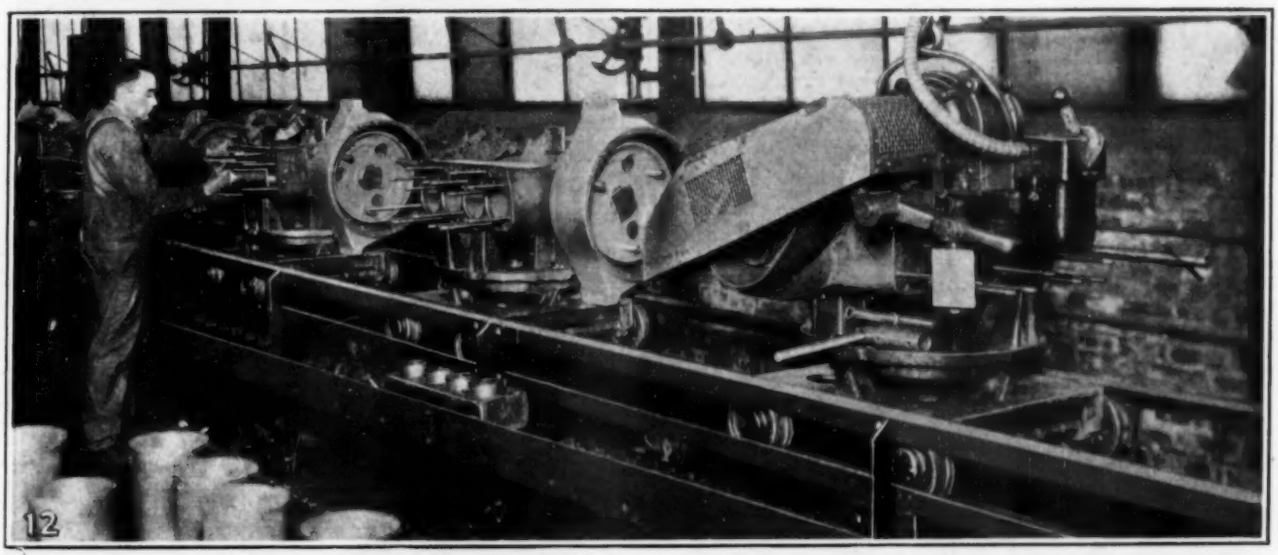


Fig. 7—Four pistons are turned simultaneously. Fig. 8—Machining cylinder-sleeves. Fig. 9—Machining crankcases. Fig. 10—Boring crank and camshaft bearing holes





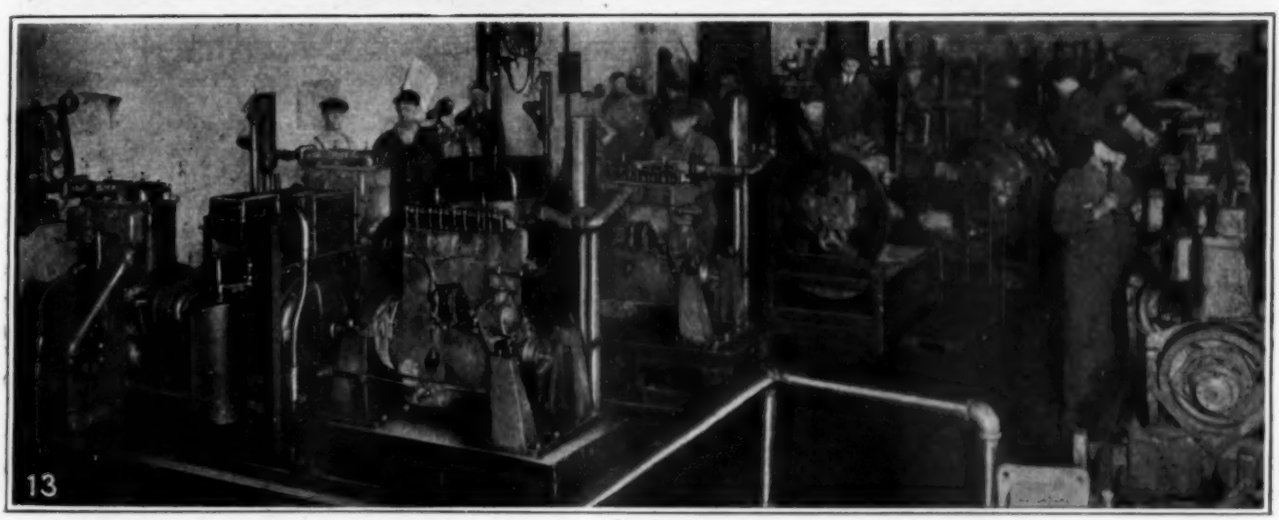
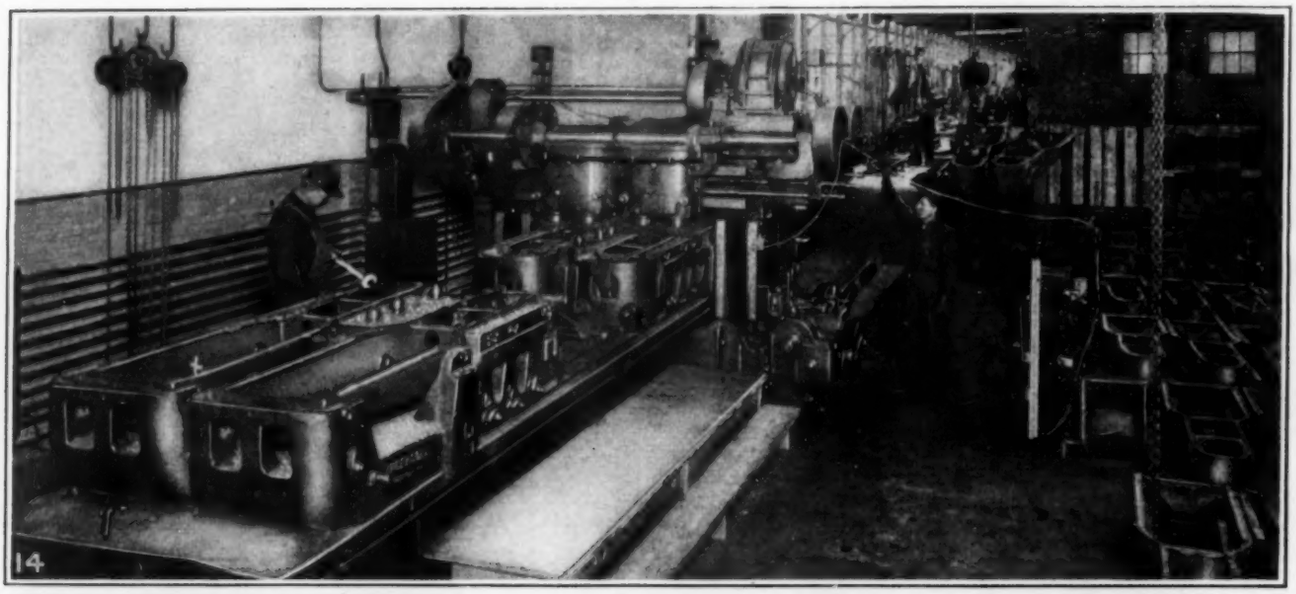
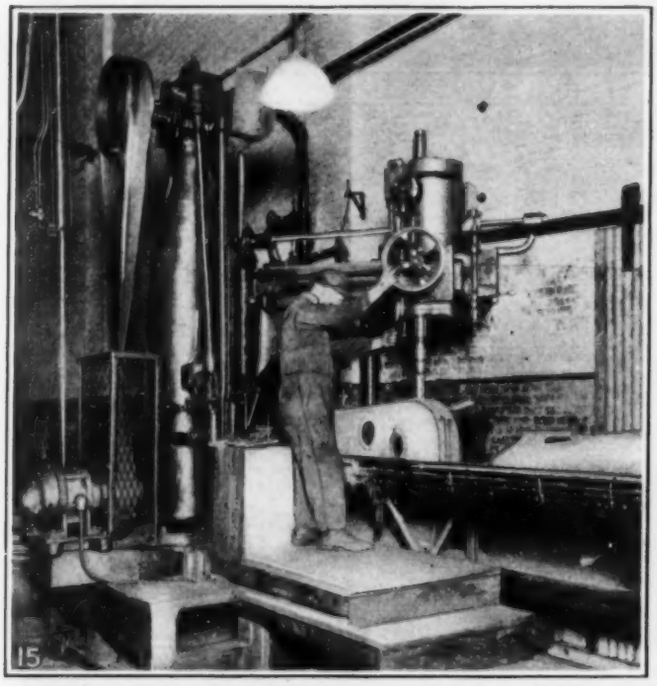
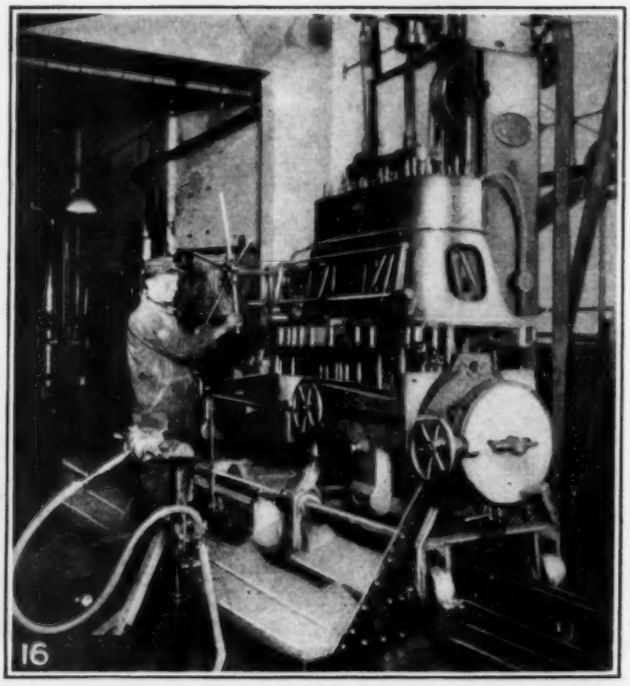


Fig. 11—Bolt-circles are drilled and tapped automatically. Fig. 12—Section of motor assembly. Fig. 13—Motor test department







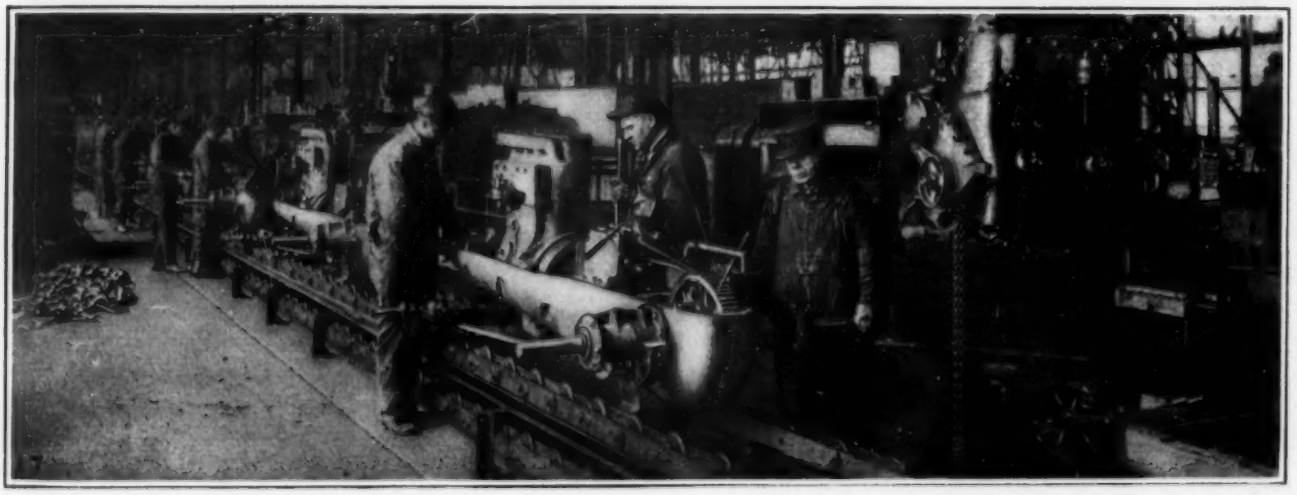


Fig. 14—Milling frames. Fig. 15—Drilling and tapping drain hole. Fig. 16—Drilling holes in face of frame. Fig. 17—Final assembly

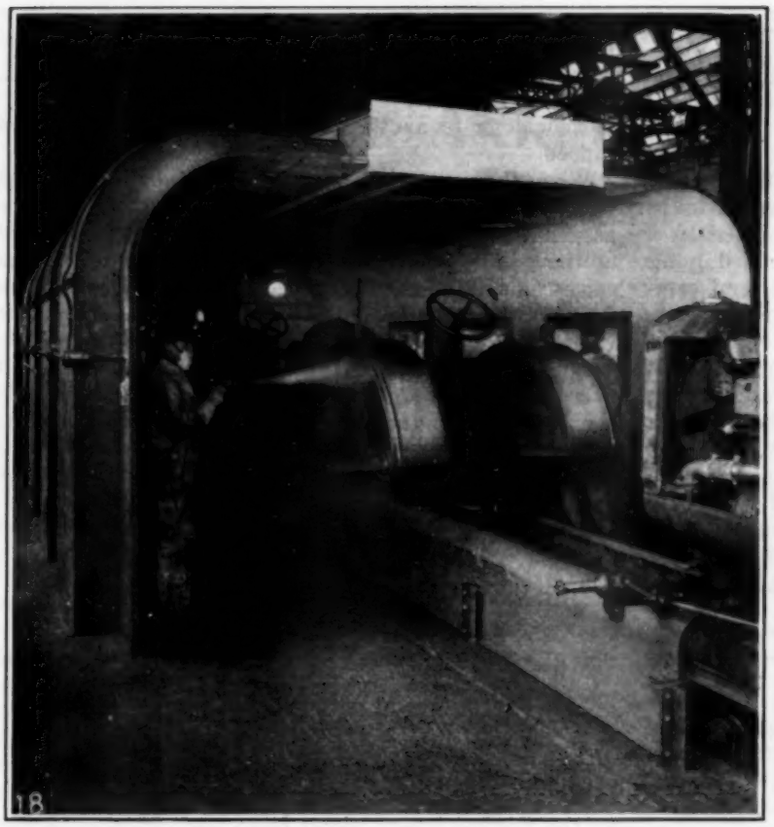
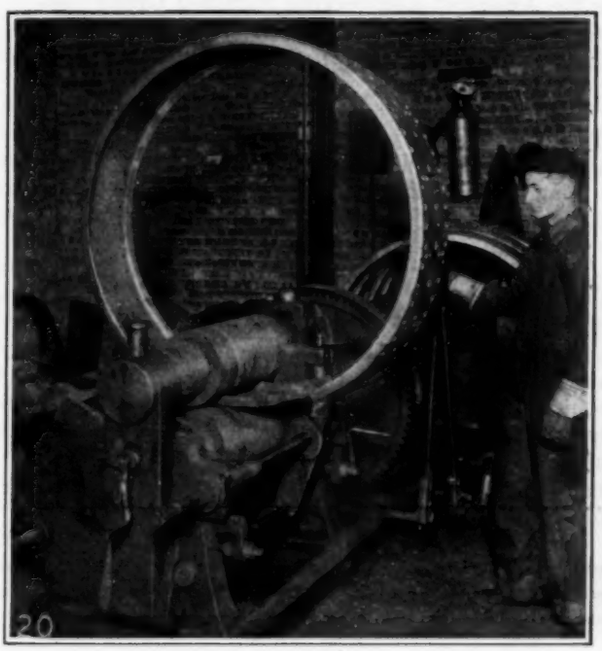


Fig. 18—Painting the tractor

Fig. 19—The tractor runs under its own power

Fig. 20—Shaping the wheels

Fig. 21—Welding seam in wheel



AUTOMOTIVE PRODUCTION

machines are operated by two men, who produce 84 pieces complete per day.

A section of the motor assembly department can be seen in Fig. 12, where a mechanic is shown fitting a sleeve to a cylinder. The sleeves are machined to a push fit. Note that the motors are assembled lying on their sides. Up to this point the crank and camshafts and fly-wheel have been assembled to the block, and the gears have been put on. In the right foreground of the illustration is shown a machine that is used in testing the gears for noise. A bracket that carries a motor is clamped to the studs in the cylinder, then a pulley is slipped over the crankshaft and keyed on with a Woodruff key and the pulley is belted to the motor. The iron weight *A* is attached to a lever that serves as a fulcrum, the opposite end of the lever carrying a pressure pulley by which the belt is kept tight. The motor runs the crank and camshafts and the operator, whose ear is trained to the job, is able to discover any flaws in the gears.

Testing the Motors

The motors are carried on a conveyor, designed and built at the Tractor Works, to the end of the department, where they pass to a roller conveyor. Here the electrical equipment is put on and the motors pass to the test room. In Fig. 13 a view of the test room is shown.

When a motor reaches the test room, it is lifted by a P & H 2-ton crane and set on one of the stands. A stand consists of an iron base with room for a motor on each end and with a 30-hp. dynamometer in the middle. The motor is started with the dynamometer and run one hour idle and one hour under load. It should then be able to pull a load equal to 22 horsepower.

The frame of the tractor is a large iron casting to which all the other parts are assembled. The first operation in the machining of the frame is that of milling the top surface, which is done on an Ingersoll machine as shown in Fig. 14. Two pieces are machined while two other pieces are being unloaded and another pair loaded. Each pair passes two sets of cutters. The roughers remove from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. and the finishing cutters remove $\frac{1}{32}$ in., producing a smooth, accurate job.

Drilling the Frame

The frames then pass along a roller conveyor to a large Western radial drill, Fig. 15, where the drain and other holes in the bottom of the frame are drilled and tapped. The next operation is that of drilling the holes in the face of the frame, which is done on a Natco multiple drill, Fig. 16. The frame is held in a reversible jig that rides on a track, as shown. The templet is carried by the machine and is lowered onto the frame when the drilling head is lowered by the operator. While the drilling operation is in process, the operator drills, using the air-motor shown in the foreground, one hole that cannot be drilled in the machine. When the operation is completed, the head is raised and the operator then throws in a clutch on the front of the car that carries the fixture, the clutch grasping a power-operated chain, and the fixture is moved along to another machine where the holes are tapped.

When the frame is completely machined, it is placed on an automatic conveyor, Fig. 17, and the parts are assembled to it. Quantities of parts are kept on hand at the points where they will be needed as the frame comes along, and are assembled to the frame while the conveyor is in motion. Practically all parts except the wheels are put on before the frame reaches the paint-spray booth, Fig. 18. Here the tractor is painted all over and as it emerges from the paint booth the wheels are put on. It then passes through a steam-heated drying room that is long enough so that from $1\frac{1}{2}$ to 2 hr. are required for it to pass through, a length of time sufficient for the drying. As each tractor in turn emerges from the drying room, the motor is started and the tractor is run off under its own power. In Fig. 19 this operation is illustrated.

Welding Rim Seams

Wheels are made of heavy sheet metal cut to the necessary width and length and then rolled to shape in the machine shown in Fig. 20. The seam where the ends come together is then welded in the Federal electric welding machine, Fig. 21. Each end is clamped in an electrode, the clamping action being controlled by the vertical levers (what looks like one lever in the picture is really two), then the operator in the pit turns a wheel that brings the two ends together. As soon as they touch, the welding process takes place, as shown. Approximately 400 small wheels or 200 large ones can be welded in a day.

Standardization of Colors An Aid to Motorists

Motorists who travel to any extent will welcome the time when the cities and towns using traffic signals are persuaded to adopt the standards recently recommended by the American Engineering Standard Committee. It has been a problem to many automobilists for a considerable time to ascertain the meaning of the dozens of systems now in use.

The advantages of uniformity should be apparent without argument, yet in more than one large city the same color has different meanings along different thoroughfares. Many accidents may be attributed to nothing more nor less than misinterpretation of signals, especially in connection with signal towers.

This situation may be largely overcome by adherence to the rule of one color for one purpose. The rules adopted by the A.E.S.C. follow, in general, the railroad practice with which the average person is already familiar. This code, therefore, will admirably meet the requirements for which it was designed and the municipalities that adopt it must inevitably be benefited not only in the reduction of motor accidents but in securing the good will of the motorist whose advertising powers are not to be scorned.

The committee also adopted several revisions in nomenclature of colors and color standards. These revisions are contained in the code published by the committee.

From Axioms To Grinds

By C. W. Bettcher
Secretary and Sales Manager, Eastern Machine Screw Corporation

Grinding the chamfer and clearance on chasers of self-opening diheads—Necessity of uniform chaser sets—Hook angle for various types of metals—Grinding practice for standard and special work

WHAT would you think of a barber who tried to shave you with a dull razor? What would you think of a carpenter who couldn't sharpen a plane or didn't know how to adjust it for the right chip? What would you think of a carpenter who tried to cross-cut with a rip saw? What would you think of a machinist who didn't know how to properly grind the lips on a drill? Now for the final question. What would you think of a screw-machine operator, or his foreman, who didn't know anything about grinding chasers for a self-opening diehead, or of a concern where nobody did — or where they didn't know that different metals, such as screw stock and bar brass, have different thread-cutting characteristics, let alone the possibility that different kinds of steel have different cutting characteristics? And yet this is not an uncommon situation as we have good reason to know.

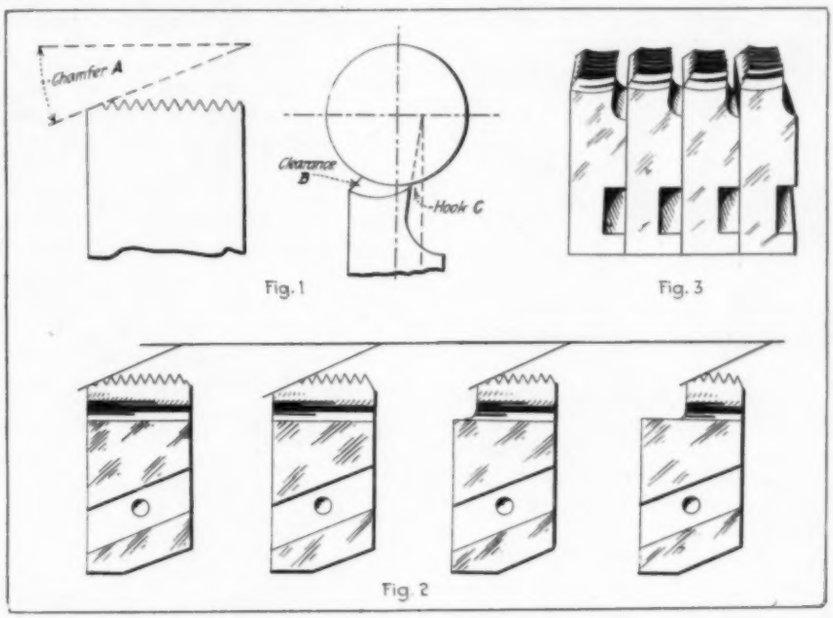


Fig. 1—Angles of chasers. Fig. 2—Maintaining uniform chamfer angle throughout life of chaser. Fig. 3—Appearance of chasers when evenly ground

What is there about chasers in a self-opening diehead that makes them more mysterious than drills, taps or other small tools? Perhaps it is because there are four of them or that they are automatic in operation. A drill, for example, has two flutes and it should be clear that each lip must be ground at the same angle, say 59 deg., in order to cut properly. With chasers you simply have four, sometimes six. Perhaps other small tools are thought less troublesome because most of them work on the inside of holes. Then again, with such tools, grinding and inspection is required on their outside concave surfaces. Their work being done on the inside of a hole, it is difficult to inspect.

Diehead chasers, however, have concave curvatures at the chamfer and an advancing thread that is apt to present an optical illusion as to accuracy of grinding, but the screws they cut are easily inspected and criticized because the threads are on the outside.

In regrinding chasers most of the grinding should be done at the chamfer or throat (sometimes called lead). The cutting face will need retouching only occasionally and should be kept ahead of the center as long as possible. In grinding chasers do not take too heavy a chip, or use too hard a wheel, or allow the wheel to glaze, because the temper of the chasers and their wearing qualities are easily spoiled in this manner, even though they do not change color. In grinding the chamfer of chasers there are two important features to be carefully watched, the angle that the chamfer makes with the axis of the stock being threaded, as illustrated in Fig. 1, at *A*, and the radius clearance of the chamfer away from the cutting face, shown at *B*. The angle *A* is often described by the terms 1½, 2 or 2½ thread chamfer. Since these terms are apt to be confusing and not interpreted alike by different individuals, it is preferable to specify this angle in degrees rather than in threads and fractions, as follows:

45-deg. angle at (a) is the equivalent of 1 thread chamfer
30-deg. angle at (a) is the equivalent of 1½ thread chamfer
20-deg. angle at (a) is the equivalent of 2 thread chamfer
15-deg. angle at (a) is the equivalent of 3 thread chamfer

The original angles can be maintained throughout the life of the chasers as shown in Fig. 2. The two chasers to the right illustrate how they may be ground back and still thread close to a shoulder. The chamfer of chasers does more than simply provide a gradual cutting edge; it serves as a means of centering the bolt or screw in the diehead just as a drill bushing might

act for a drill. If the chamfer is uneven it has a tendency to throw the screw to one side. The clearance on the chamfer is also important, for if there is not enough, the screw will rub hard behind the cutting edge, whereas, if there is too much clearance the chasers may chatter from lack of proper support and have a tendency to dig in.

Where one chamfer, in a set of chasers, is not the same as the other three it distributes the burden of cutting unevenly among the set. The feed of chasers, at a given speed, is fixed by the pitch of the screw, but if chamfers are uneven, one or two of the chasers will remove an excessive amount of stock in proportion to the feed, producing poor threads and the rapid dulling of the chasers.

Grinding the Clearance of Chasers

The radius clearance on the chamfer, back of the cutting edge, should always be slightly concave—never convex. It should have about the same curvature as the stock that is being threaded. When the chamfer is ground properly, that is, when the same amount of metal is removed from each chaser in a set and at the same angle, it will be noticed that the first thread or groove in each chamfer will not come at the same place, as the first thread advances one-quarter of the pitch in going from one chaser to the next (assuming there

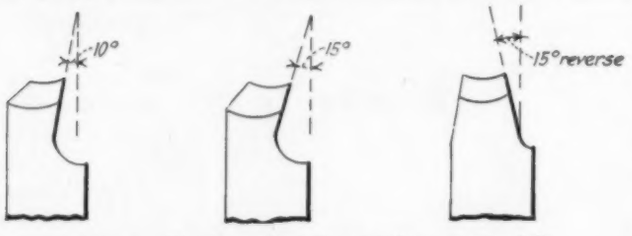


Fig. 4—Hook angles for various materials

are four chasers in the set). When a set is arranged in the proper sequence or order, such as 1, 2, 3, 4, or 2, 3, 4, 1, or 3, 4, 1, 2, or 4, 1, 2, 3, as the case may be, it will have the appearance as indicated in Fig. 3. Notice the advance of the first thread in each chaser in going from one to the next.

The chamfer, at its widest part, must be of greater diameter than the outside diameter of the stock to be threaded. In grinding chamfers on chasers be sure the lowest part is below the bottom of the thread on the chaser in order to clear the outside diameter of the stock. If cutting oversize stock, or stock out of line, the chamfer must be still wider. With certain classes of metals it is often desirable to grind the chamfer with slightly more than ordinary clearance to insure free-cutting of the stock, while other kinds of stock might require slightly less clearance in order to produce a smooth thread. The best results for average conditions will be the original chamfer as ground on new chasers.

The Cutting Face

The cutting edge on each chaser in the set must be the same height. Unless otherwise ordered, chasers are usually furnished with the cutting faces ground to a 10-deg. hook and a cutting edge of about one-tenth of the diameter ahead of center. This has been found to be most suitable for the average run of steel stock and is known as a standard hook. Certain kinds of stock may require different hooks and it is necessary that the chasers be provided accordingly if good work is to be expected. The hook, or rake angle, is indicated at *C*, Fig. 2, and in Fig. 4. In regrinding, if the cutting edge is ground nearer to the center, the hook angle should be increased slightly to give the same effect as the original amount ahead of center as shown in Fig. 5. For example, with a 10-deg. hook *C* and a cutting edge of originally one-tenth ahead of center *D* the hook should be increased to 20 deg. *E* when ground to the center in order to give the same ahead-of-center effect as originally obtained.

The direction of rotation of the wheel is often an important factor in the results obtained. In regrinding the cutting face, it is desirable to have the contact-edge of the wheel rotating in a direction towards the chamfer-end of the chaser. Any burrs thrown on the teeth will then be on the leading or cutting side of each tooth, whereas, the rear or bearing side will be clean and provide the bearing for advance without shaving. In fact, it is good practice to remove burrs from the individual teeth to prevent shaving from the drag in the machine. A knife, or sharp piece of steel, is best for this use as they will not change the thread form.

Special Conditions

The more that the hook angle is ground on the cutting face, the more acute the angle becomes at the cutting point where it meets the curve of the thread. This approaches a knife edge, if extreme hooks are used, that will not wear well, having a tendency to chip readily. It is, therefore, poor practice to use a greater hook than is necessary to give good cutting results. Sometimes, chasers are found with excessive hooks where less would work satisfactorily and offer better wear. The same thing is true when the chamfer is ground with excessive clearance.

On hard stocks, it is good practice to grind chasers frequently, otherwise, when they start to wear they will go rapidly. Hence, more stock must be removed in regrinding, making their life shorter than if they were reground more frequently. The analysis, or S.A.E. specifications, of stock, will not always determine its cutting characteristics, as certain elements contained may be near the high or low limits and have an important bearing on the threading qualities. The cutting characteristics depend as much on how steel is made as on its analysis. It is not an uncommon occurrence to see two lots of steel of the same specifications, one from one mill and one from another, where one lot has good cutting characteristics and the other is almost impossible. Sometimes this is even true of two different shipments from the same

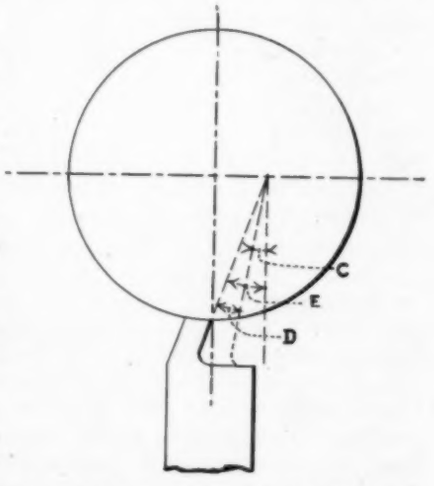


Fig. 5—Chaser ground ahead of center

mill. Poor threads on steel are often the result of the stock having no trace of sulphur and phosphorus, as, without any trace of these elements it is almost impossible to have free cutting. Dirty, scaly, or stock with slag, dulls chasers rapidly. High manganese will dull chasers rapidly.

In the case of heat-treated stocks, the uniformity of the heat treatment is important if uniform results are to be obtained. Likewise, the character, depth and uniformity of the anneal are equally as important. Sometime ago the words "cold rolled" were often used to indicate Bessemer screw stock. Actually, however, the words "cold rolled" indicate the finish only. Today we find high-carbon steels, as well as low, that are cold rolled, each with different cutting characteristics.

The use of stock with poor cutting characteristics is an expensive practice. It is not unusual to find this the cause of a loss in production of 25 to 50 per cent, or even to almost no production at all. The tool cost becomes excessive and such expense should be weighed against the necessity of using such stock. If a certain lot of a given specification of steel works poorer than another lot, the maker of the source of supply should be notified and the stock laid to one side. The rate of production is such an important factor in costs, nowadays, that producers should give proper consideration to machining qualities of the stock and insist on uniformity rather than blame the tools. It should also be remembered that variations in cutting characteristics may require different grinds and lubricants.

The proper grinding of chasers is one of the most important features in the production of threaded parts. Its importance cannot be overestimated. The operator should thoroughly understand (1) what characteristic grinds of chamfer and cutting face are required to get the best results for his particular conditions and (2) the best method of obtaining this particular grind and duplicating it in order to get uniformly good results. In connection with the last mentioned, he must bear in mind the proper locating or working points of the chasers, consisting of the bearing surfaces on the chasers that are in contact with the cams that operate them in the diehead. The chasers should be so located in the fixture for grinding that the amount of metal removed would be the same for each chaser in the set, and then each chamfer and cutting face will have the same individual relation to the screw that is to be cut.

Safety in the Machine Shop

IF we had used the term "Safety in the machine shop" a few years ago, we would have received questioning glances, as much as to say, "You mean 'Danger' in the machine shop." And the machine shop of yesterday with its exposed belts, wire belt laces on shift belts, exposed set screws revolving about on shafting, exposed gearing, hoisting apparatus of questionable capacity, bad floors, lack of guard rails, poor light, etc., was truly a dangerous place.

In my own experience I have witnessed many serious and quite a few fatal accidents in machine shops.

Not one of these accidents could happen in a *modern* machine shop. Those who are familiar with machine tools of today know that a planer with individual motor drive, direct connected with variable speed reversing motor and elect, panel controlled, well covered gears and centralized control, is a tool that is really difficult to get hurt on; that a modern lathe is no longer a mass of open gearing, to be handled as gingerly as T. N. T., but a compact, thoroughly inclosed machine that an operator does not have to watch for fear it will take off an arm or a few fingers every time he starts it up. And so on all through the line of machine tools, such as shapers, upright and radial drills, boring mills, erecting cranes, they are safe efficient machines and the modern machine shop, in spite of its noise and apparent confusion to one who is not used to shop conditions, is almost as safe a place as a bank or a department store.

There is a phase of accident prevention, however, which needs to be stressed and which has never had the proper emphasis and that is the view that safety and production are as inseparable as the "Gold Dust Twins." You not only don't need to sacrifice safety to get production, but you can not get production without being safe. Whether we want to admit it or not, there was in the mind of every superintendent and production man when the Safety movement started, this thought:

"'Safety first' is all right, I believe in it." (He did not dare say any less), but he always made this mental reservation—"Production is my job. I am paid to produce and I am going to accept just so much of this 'safety first stuff,' as I can take without interfering with my own work." And that is exactly what he did.

More Production, Less Danger

You make a call on any machine shop superintendent and as he takes you through his shop, you watch the things that he points to with pride. You will note that they are short cuts to production. And every time you cut the time necessary to produce an article you cut the hazard of doing the work. While we have gone along under the pressure of modern business about our regular job of producing, keeping our shop clean, orderly and productive, we are keeping our shop safe.

Note the words "clean" and "orderly." These conditions contribute equally to safety and production. No man can produce his full quota of work in a shop where the machinery suffers from lack of proper maintenance and slipshod housekeeping methods—or rather lack of method—prevail. Under these conditions the worker's chances for injury increase as his productiveness decreases. Assuming that the plant layout is as near perfection as is humanly possible to start with, the maintenance and supervisory forces must do their part in maintaining the mechanical and educating the human elements or the production records will be disappointing and the accident records distressing.

We owe many things to the safety engineer. He made us do many things long ahead of our own volition and in doing them we increased production. If we can get the idea that whatever makes a machine shop safer makes it more productive, and that whatever makes a machine shop more productive makes it safer we will have sold safety to every superintendent and production manager.

I referred to production and safety as being twins, but the comparison is rather weak. A better analogy would be the oxygen and hydrogen in the water we drink. We can not take a drink of water without swallowing oxygen and hydrogen in the right proportion for our bodies. We can not operate a machine shop of today without having safety and production in proper proportions.

Abstract of an address delivered by A. K. Dean, before the Central New York Safety Conference, Rochester, N. Y., June, 1925.

Book Reviews

Basic Principals and Recent Progress in Gear Tooth Generation. By Karl Kutzbach, Professor at the Dresden Technical High School. 70 pages, 7x10 in. Illustrated. Paper covers. Published by VDI-Verlag G.M.B.H. Berlin SW 19, Germany. Price 5 marks.

According to the prospectus accompanying this German booklet it is an "indispensable adviser to all those concerned with the design, construction, and application of gears." It includes descriptions of modern gear cutting machines of various types, each illustrated. There are two supplements, one concerned with the conceptions and notation of spur and bevel gearing, the other treating of methods of gear tooth correction. The first supplement has the English equivalent of the German term for each gear part and gear cutting process and consequently furnishes a vocabulary of German technical words that are not found in dictionaries.

Shop and Office Forms, Their Design and Use. By Wallace Clark, Consulting Management Engineer. One hundred and thirty-four pages, 6x9 in., cloth boards. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York City. Price $2.50.

Mr. Clark points out that when compared to the effort put forth in connection with production work, the effort exerted upon forms has been entirely too little. He tells of the importance of forms to management in the control of work; the necessity for the simplification of clerical work; and of the design, movement and economical use of forms. Many examples of forms are given.

The first part of the book deals with the technique of designing forms. The second part shows the relation of forms to the management of certain typical shop and office departments. The third part takes up the general administrative features connected with forms.

In writing the book Mr. Clark has drawn from many years' experience in shop and office work. He has produced a work of merit, valuable to management and very well written.

Practical Descriptive Geometry. By William Griswold Smith, M.E., Assoc. Prof. of Mech. Eng., Northwestern Univ. Third edition, revised and enlarged. 281 pages, 6x9 in. Illustrated. Published by McGraw-Hill Book Co., Inc., New York. Price $2.50.

The purpose of this, the third edition of the author's original textbook on Descriptive Geometry, has been to revise the exercises and illustrations used in the earlier editions. These changes have been made as a result of the extensive class-room use of the book and in accordance with the comments and suggestions of teachers who have read the book.

The work has shown itself a particularly serviceable one, well adapted to class-room use. Presupposing no more knowledge of mathematics and mechanical drawing than is a necessity, the work begins with a thoroughly elementary treatment of the methods of projection. Theorems of plane and solid geometry are reviewed to refresh the memory of the reader so that a thorough grasp of the fundamentals of the subject is possible. The preliminary theorems and definitions are well ordered and emphasized sufficiently to impress the student, and each group of theorems is followed by exercises conceived in accordance with the practical character of the work.

The author has considered the usual treatment of the problems relating to points, lines, and planes as inadequate and has, therefore, greatly enlarged it, from the 17 original problems to 42 in the third edition.

The sections on Shades and Shadows, and Pictorial Projection, are handled briefly but are sufficiently complete. There seems to be no evidence of a tendency, frequent in such subjects, to lose sight of the fact that the work is not one on art, but dealing purely with mechanical drawing.

The remaining third of the book deals with single-curved surfaces, warped surfaces, and surfaces of revolution in a fashion such as to make unescapable the impression of good balance and proportion throughout the work.

The principal criticism of the work is a tendency, quite frequent in textbooks on mathematics, to be unnecessarily concise. This, a result of the habit of formulizing, is a field in which we may still look for improvement.

With this one exception, however, the book is quite successful in its attempt to treat the subject not only in a practical and complete manner, but also to make it attractive and interesting to the student. Of course, in this field of science, to a great degree, the practicability makes for the attractiveness of the text.

The Model T Ford Car. By Victor W. Page. Latest edition revised and enlarged. Four hundred forty-nine pages, 5x7⅞ in., board covers. Illustrated. Published by The Norman W. Henley Publishing Co., New York City. Price $2.

This book was written especially for owners and drivers of Ford cars, and contains explicit directions for operating and making repairs, as well as diagnosing troubles. All the various parts of the car and their uses are thoroughly explained.

An important feature of the book is a list of the prices for labor allowed to be charged by Ford service men for making all kinds of repairs. Having a price list of Ford parts and the labor charges, the owner can tell in advance the cost of any particular repair, provided the work is done at an authorized Ford service station.

Sections of the book are devoted to operation, maintenance and repair of Ford trucks and Fordson tractors.

The book should be in the hands of every Ford owner and user, and if studied carefully it will help in giving a thorough understanding of the car. If the directions for operation and maintenance are followed much expense will be saved.

Erratum

In the book review on page 1006, Vol. 62 of the *American Machinist*, the Simplified Practice Recommendation No. 18 was erroneously credited to the United States Chamber of Commerce. This should have read "United States Department of Commerce," the book being one of that department's series on "Elimination of Waste."

Some Comments on Engineering Department Organization

By P. H. Bryant

Engineers best suited for small engineering departments — Necessity of accomplishing undergraded work — Numbering drawings and distributing work—Co-operation and conferences

THE organization of a small engineering department, on a basis to secure a fair output and a high degree of accuracy, offers one of the most perplexing problems in industrial development. By the term small is meant a department large enough to require systematic control of its personnel, yet too small to permit definite and permanent assignments of individuals to certain classes of work. In a department of this character there are times when employees must be asked to do, and must expect to do, work below the grade they feel themselves fitted for and oftentimes below what they were hired and paid to do. The unexpected situations that occur in any industrial plant usually hit the engineering department first and with the heaviest pressure, so that it may be necessary for engineers to act as layout men or detailers, in order to gain the action that such situations make imperative.

Requirements of an Effective System

On account of the necessity of frequently breaking into a smoothly operating department and turning it topsy-turvy for the time being, it seems that the definite organization of a small engineering department is impractical, and that the supervisor is only required to hand out work as the men finish their previous assignments and perform the general clerical duties of a department head. Such belief may be through the ignorance of the work to be accomplished or it may be through the lack of sufficient interest to master the necessary problems. In either case, the problem is there and that one or several solutions are possible is proved by notable examples of work that is being sent out from small companies of such high quality, both from the standpoint of engineering and technique, as to attract special comment and commendation from those in a position to pass judgment. Consult any plants doing contract work, such as tools or special machinery, and they will tell you that a large percentage of the specifications and drawings that pass through their hands are crude and inaccurate, providing an endless store of humor for their own executives. On the other hand, they have numerous examples of work of high quality, and in such cases have been heard to remark that "there is a job that was really engineered." Assuming then, that from such engineering departments a better quality of work and greater output can be secured by a definite system of handling, what are some of the requirements and what are some of the present practices that must be discarded to make any system effective?

The organization should start with the hiring of the men, who, regardless of age, experience, mental qualities and wage scale, are willing to do work at times below their rated ability, and to put the same interest and carefulness into the "kindergarten" jobs that they would in work of the highest quality. The engineer who is always an engineer and who will not do work of lower grade, cannot be reconciled with a workable system of the small department organization, and regardless of his qualifications, would be an obstacle in the way of getting results. With a graded force to cover the necessities of designing layout work, construction drawings and detailing, and with each unit a "utility man," the quality of the output then becomes largely a question of the method of handling by the department head.

One of the first requisites is the adoption of a fixed set of rules to be observed by all employees. Lack of definite rules leads to incomplete specifications, unnecessary checking and rechecking, and innumerable arguments wasting time and brain effort that could be put to better uses. It would be difficult to find two draftsmen who would dimension such elements as tapped holes, keyways, and the various types of gearing with any uniformity, yet each would be certain that his method was the best, and if left to himself would argue to maintain the prestige of his ideas. Such matters should not be left to haphazard opinion, but to definite printed directions that should be furnished to every employee. The methods of practice for that department should never be a matter of controversy between employees, whether they do or do not conform to the standards accepted elsewhere. The only point of attack should be to the department head, to whom any employee should be privileged to submit his personal opinion as to the correctness or completeness of any rule.

Numbering Drawings and Distributing Work

A definite system of sizing, titling and numbering drawing sheets should be adopted at the start. No mistake of early disorganization is harder to straighten out than a mass of drawings of miscellaneous sizes and without numbering or recording, that were made with the idea that no system was necessary until the department was producing. There are so many methods of numbering drawings that comment is superfluous, but some systems have features that make them more adaptable than others. It appears that all the systems that are used are lacking in full adaptability to all the conditions that may arise. From experience it would seem advisable to keep away from attempting to make the

part number a key to its title as such a system tends to become confusing and burdensome. The most common practice is to limit the use of letters to an indication of the size of the drawing, this letter being placed in front of the number and separated by a dash, and to letters placed after the number to indicate revisions. Thus C-1462C indicates a drawing of C-size and that three revisions have been made, making the drawings bearing the C-1462, C-1462A, or C-1462B, obsolete and dangerous to use. Comparatively few systems raise the number of the drawing with each revision, but it is fully as important as any numbering feature.

No definite system can be made for giving out work, as this is entirely a question of judgment on the part of the department head. The greatest possible error, in this regard, is to follow the quite prevalent practice of handing out jobs in a consecutive order to the workers as they finish their previous assignment. A department head having the ability of judging men should quickly determine that certain men in his force are better adapted to do certain classes of work, and should plan to have such men available when necessary. The distribution of work is made complex as we have before indicated, by the necessity of rushing through a piece of work in record time. In such cases men of wide experience are often set to mediocre tasks, and sometimes they will find features about the job that they do not feel are right. This situation raises its own difficulties, but the safest and least troublesome way out is to establish a rule that each employee is to confine himself to the limitations of that class of work and be free from any responsibility beyond that to which a workman of that class would ordinarily be subject. For example, a designer is asked to rush a certain piece of work into shape for production, that previously had been handled by a man of inferior ability. His first impulse is to redesign the whole element, but to do that would take more time than is available. Under such circumstances it would not be reasonable to hold this man responsible for the results, and it should be understood that under such circumstances the workman is not to be responsible.

There should also be a clear and strict understanding against employees working above their class. Every amibitious draftsman of the preliminary grades is in his own mind a creative genius of high rank, and in the small drawing room his tendency is to produce original designs and make corrections on drawings that he believes to be an improvement. In this case, as in the first mentioned, a definite and thoroughly understood rule, from which there is no laxity, is the best remedy.

Recording Work

It is frequently the case in departments that seem well systematized that it is a tedious and time consuming task to find a drawing of a desired part. The reason is that the records are generally kept numerically, whereas the average man wanting a drawing knows it by the name or the nature of the part. The best insurance against this difficulty is cross-indexing. It is well to remember that parts shown on drawings are frequently called by almost any other name than that given in the title on the drawing and for this reason the cross-index should be based on the classification of the part rather than on an alphabetical arrangement by titles. For example, Gear-Bevel-Rear Axle Pinion, as a title for a Rear-Axle Bevel-Pinion Gear, will group all of the bevel gears into a major division and make the part much easier to locate.

Passing from the details of organization to some of the invisible elements that bear directly upon the quantity and quality of the output, it should be understood that results are materially affected by the attitude taken by the department head and his superiors toward the men of the department. At a recent meeting between the executives and engineers of a large plant, the general manager remarked that engineers were a peculiar lot and the hardest to handle of all departments. Probably from his standpoint they were peculiar, but it is equally probable that this peculiarity was created from an outgrowth of methods used by him in dealing with that department. Methods that are legitimate and productive of results will not work at all, except negatively, in a department for development. It is the psychology over again of leading the horse to water and not being able to make him drink. You can drive a machine operator to a certain action and his machine will do the rest, but you must not drive a man engaged in creative work at a speed in excess of his natural mental capacity and expect to get greater brain output, because the evidence of experience teaches that the contrary is the result. It does not save time to rush engineering work, for the higher grades of men generally do the poorest and least work when put under pressure, and reach the peak of their ability when allowed to set their own pace.

Engineers Hard to Control

It is this characteristic that has given rise to the comment that engineers are a peculiar lot and hard to control. Managers who try to railroad work through their engineering departments have been chagrined at their failure to get a better product in a shorter time with a lowering of both quantity and quality. This is peculiar without a doubt, but its peculiarity disappears when the personal characteristics of the employee are given consideration and dealt with accordingly.

In line with personal characteristics, it may be well to comment on that common expedient for increasing output—working overtime. In cases of great stress requiring an amount of work greatly in excess of normal in a short space of time, overtime in engineering work will get satisfactory results, but as a steady diet, with the purpose of increasing the normal output, it is an absolute failure. An appreciable rise in the curve of the output is generally noticeable for a short period, not more than ten days at the most, and then a drop below the normal level of regular time.

While the average working day of the engineer is eight hours, few if any are physically fit to concentrate all their mental faculties for that length of time. The day's work consists of periods of concentration, followed by rest and change of thought, and experience has taught that only by this expedient of alternating concentration can the average man carry on from day today. If this condition be conceded, and any engineer of experience will admit its truth, then all that can be gained by protracted overtime would be decreased by the added fatigue. A brain worker is the best producer because he can burn the candle at both ends for a period of two or three days and make up for it afterward by an extra period of relaxation.

Lately, we have come to hear a great deal about co-operation as a possible cure-all for organization

troubles. Co-operation in principle is all right, but as a word and a force it is being promiscuously used, and is becoming a menace through its misuse. The dangerous feature of co-operation is the tendency to use it as an easy way out of difficulties that require managerial ability to master. It is common practice to call the personnel of a department together and make an appeal for their co-operation to help straighten things out, with the idea that nothing else is needed to correct the difficulties other than the co-operation that is asked for. This is an erroneous practice and can lead only to disastrous results if persisted in.

Co-operation must never be used as a substitute for proper supervision. Engineers and men growing in the engineering profession are too reasonable in their thinking to reconcile managerial blunders by appeals for their extra effort to help repair the damage caused by those blunders. What more can a man do in the way of co-operation than to give all the effort and the best thought he is physically capable of? Any worthwhile workman will co-operate as a matter of personal pride, and the other kinds are not the sort to be touched by appeals to sentiment. It goes without saying that any member of an organization who can not, or will not co-operate with his fellows, has lost his usefulness and had best seek employment elsewhere.

Holding a Conference

Another feature of organization that is much in vogue is the conference—a free exchange of ideas between the creative minds of the department, and sometimes the submission of work performed to a general scrutiny and criticism. Like co-operation, the conference principle is a dangerous factor to deal with and unless tactfully handled will set up more ills than it will cure. It is the safest to conclude that it has no place in a small department, because as a consequence it more than doubles the time required to complete a design, and few plants would shoulder such a burden even if shown that the standard of output is raised.

The conference has no place between men of identical training and experience. Assuming a department has, beside the chief, four engineers of the same grade, and that a design, the work of one of the four, is submitted to the committee-of-the-whole for comment, not one of the four critics would have done the job in the same way. A conference would lead to discussions and arguments of the merits of each individual's thought as to how he would have done the work if it had been assigned to him. Some benefit might be derived but the chances are strongly toward disruption, jealousies and delays, all of which are fatal to the well being of any organization.

When a Conference Helps

If the work involved a complex milling job, it might save cost to confer with the designer or the company's authority on milling operations. Such a man will not tear to pieces the work of the designer, but will supplement his thought with practical suggestions as to the details that will bring the job in closer adaptability to the machines that must produce it. Bringing to bear experiences of certain details covers the true function of the conference, and when otherwise used it becomes a nuisance and a burden. However, if the conference be used solely as an interchange of ideas as to the best methods of procedure, it will many times be useful and economical in solving certain problems.

Specifying Tool Limits

By William F. Sandmann

Plus or minus one-tenth of a thousandth of an inch means but little to the average tool designer and it is as easy to place such a limit on a drawing as it would be a more liberal one, the closer tolerance probably appearing more impressive. If the design, bearing such limits, goes to your toolroom, the designer's attention would probably be taken literally, as the toolroom foreman is generally of the caliber that would make the jig or fixture, or whatever it happens to be, to corresponding practice, whether the limits of the finished product agree with the design or not.

With the majoritiy of plants, there are occasions when it is necessary to "farm out" a portion of the tool work, especially if the toolroom is filled to capacity. When such a condition is necessary, and a number of contract bids are sent out, the estimates may seem unreasonably high, or if the work is handled on a time and material basis, there may be a complaint upon presentation of the invoice due to excessive charges. By consulting the toolroom foreman of the plant desiring the work, it may be learned that the job should have cost a great deal less, or that the bids submitted are out of line. If this condition exists, do not call the specialty shop robbers. First examine the tool drawing from which the work was done or estimated and note carefully the limits that have been allowed. Are they close?

Your toolroom foreman remarks, "they didn't have to be held that close." If your shop had done the work, they wouldn't have been either. But how was the specialty tool shop to know that? How were they to know that the tool would pass your inspection unless they rigidly maintained your limits?

Keeping to Dimensions

One of the largest manufacturing plants in the country is notorious among tool men for the fact that they will reject a tool or jig even if an unimportant, obscure dowel pin, that has absolutely no bearing on the efficiency of the tool, is a fraction different from the design. They dimension their drawings accordingly and are willing to pay higher for their tools.

Remember that the specialty shop has your design to follow. If the designer has placed a dimension of 0.9999 to 1.0001 in. on the bore of a hole into which is to be pressed a bushing bearing the dimension 1.0029 to 1.0031 in., the tool shop must take you at your word and spend the time necessary to get these dimensions accurate. Your own foreman would probably have told the toolmaker to simply make the bushing a press fit in the hole, or if standard bushings were used the hole would probably be held a trifle more accurate. But plus or minus one thousandth of an inch is close enough for practically all work and it allows ten times the leeway that plus or minus one ten-thousandth does, costing a great deal less to attain. And limits often as high as five or ten thousandths will suffice just as well.

If you have work done outside of your own plant, be sure that your draftsman revises the limits and, if the work will permit, substitutes such terms as "slip fit" or "press fit" wherever possible. Your tool invoices from the specialty shops will immediately reflect the change to the credit of your bank account.

Aluminum Solder—Discussion

By E. Darwell
Lancaster, England

IT WAS with much interest that I read the article by E. Andrews under the title given above, and published on page 437, Vol. 62, of the *American Machinist*. I should like to add a few remarks to Mr. Andrews' article regarding the practicability of soldering aluminum.

The question of soldering aluminum is a greatly debated subject, and possibly rightly so, because few mechanics can make a permanent, sound joint. It is well known to those accustomed to soldering metals, that there is no solder that acts with aluminum, or even aluminum alloys, in the same way that ordinary solders (tin-lead alloys) operate with copper, brass, monel metal, or tin plate. Aluminum does not alloy readily with solders at temperatures as low as other metals require, and consequently it is necessary in soldering aluminum to use a much higher temperature. Furthermore, aluminum alloys with lead solders with great difficulty. Consequently lead solders are unsuitable for aluminum. The refractory layer of oxide formed, particularly at soldering temperatures, is undoubtedly responsible for the principal portion of the difficulty that occurs in soldering aluminum.

I am whole heartedly in agreement with the following statement of Mr. Andrews: "It is a mistake to speak of soldering aluminum as an ordinary tinner means soldering—with a hot copper and a solder that will flow and follow it." Aluminum and its alloys are not soldered that way. A higher degree of heat is required to solder aluminum than can be conveyed by means of the ordinary soldering copper. Very largely, failures in soldering aluminum can be traced to want of regulating the heat used in the process.

The Importance of High Heat

In ordinary tinners' or plumbers' soldering operations, not more than from 450 to 500 deg. F. is needed, but for soldering aluminum or its alloys, quite 600 to 700 deg. F. is required. Moreover, aluminum solders are best applied without a flux after preliminary cleaning and tinning of the surfaces to be soldered. The composition of an aluminum solder may be varied within fairly wide limits. It should consist of a tin base with the addition of zinc, or of both zinc and aluminum, the chief function of which is to produce a semi-fluid mixture within the range of soldering temperatures. When in contact with aluminum and in the presence of moisture, both tin and zinc cause a galvanic action by which the aluminum is attacked. In the actual operation of soldering aluminum, the layer of oxide must be removed before soldering can take place, and since it forms again almost instantaneously, it is necessary that the removal of the layer of oxide and the covering with solder should be simultaneous.

In soldering other commercial metals, the layer of oxide can be easily removed chemically. With aluminum, the presence of oxide is a very serious matter and it is best removed mechanically by abrasion. The surface to which it is intended that the solder shall adhere, must first be tinned, and as the success of the soldering operation mainly depends on thoroughly tinning the parts to be joined, some little time should be devoted to this process that was described by Mr. Andrews in the article referred to.

With our present knowledge of aluminum, the patent twin solders mentioned by Mr. Andrews are undoubtedly a step in the right direction toward solving the difficulty of producing permanent, sound, soft-soldered joints in aluminum and its alloys. It is, perhaps, not overstating the case to say that not one out of ten at the present time can guarantee that a joint made with a special aluminum solder will remain permanently sound. A convincing test is to boil a soldered joint for a few hours in water that is slightly salt.

Aluminum can readily be soldered to brass, copper and steel by ordinary methods and with ordinary soft solders, after the surface of the metal has been previously tinned with a suitable tinning alloy. If zinc chloride has been used as a flux for tinning the brass, copper, or steel surfaces, care must be taken to wash away every trace of the flux before jointing the metal to the aluminum.

What Not to Do

The following "Don'ts" will be found useful for the machinist or automobile repairman, when trying his skill in soldering machine and automobile components fabricated from aluminum or its alloys:

1—Don't attempt to solder aluminum until the surface to which the solder is to be applied has been thoroughly cleaned, because aluminum solders adhere only to bright and clean surfaces.

2—Don't expect to get good results unless the surfaces to be soldered have been properly tinned.

3—Don't forget that an atmospheric blowpipe or blowlamp flame used for heating must be free from free carbon, and should only be employed in heating the parts to be soldered—not the solder itself.

4—Don't attempt to solder aluminum until the metal near the joint has been raised almost to the melting temperature of the solder.

5—Don't overheat the metal, or its strength will be impaired.

6—Don't expect the solder to flow with such rapidity as in soldering such metals as brass, copper, tin plate, etc., for aluminum solders usually flow sluggishly.

7—Don't forget when soldering joints in sheet aluminum, that the distance of the overlap of the pieces to be joined should be much less than that usually allowed for other sheet metals, because solder will not flow into an aluminum joint, even when tinned, as it will into brass, copper or tinned-steel joints.

8—Don't forget when soldering broken articles of aluminum or its alloy castings to remove all foreign matter from the sides and edges of the fractured parts, either with a scraper, steel wire brush, or file. Grease should be removed by burning it out.

9—Don't expect a true union between the solder and the aluminum, unless the surfaces are thoroughly rubbed or scraped with a well-tinned tool during the actual soldering operation.

10—Don't move the work until the solder has thoroughly set, but keep the soldered parts under slight pressure.

11—Don't forget to use a single-cut file when filing soldered joints.

12—Don't take it for granted that you are using a perfect aluminum solder until it has been subjected to varied and rigorous tests. Good results will not be obtained if the metal is soldered in a dilatory manner. Smartness is the keynote to successful aluminum soldering.

© Harris & Ewing.

A navy bomber equipped with 450-hp. air-cooled engine

Research Laboratories in Aeronautics at New York University

What the Guggenheim gift will mean in the development of flying

THE establishment of the Guggenheim School of Aeronautics in the College of Engineering of New York University will provide a course of instruction for both undergraduate and postgraduate students of the most solid and comprehensive character. It should also give New York University facilities for aeronautical research unrivaled by any educational establishment in the world.

New York is the center of the aviation industry in the United States with such well known plants as the Curtiss Aeroplane and Motor Corporation, the Wright Aeronautical Corporation, the Loening Aeronautical Engineering Corporation and many others located within a twenty-mile radius of the University. An opportunity exists therefore for the closest co-operation between the industry and the University laboratory.

Commercial Efficiency Now the Goal

The science of aeronautics under the impetus of the war has had as rapid a growth as perhaps any modern branch of engineering. There has been the most rapid progress in aerodynamics, in the structure of the airplane and in power plant problems. But the art is far from finality and an immense amount of work remains to be done. Moreover, under the influence of war needs, experimental construction in the United States has had a tendency to concentrate its attention somewhat on military problems, with the attainment of great speeds, great climbing capacity and maneuverability as the main objects of achievement. With the success of the Air Mail and the establishment of private air lines, the time has come for the orientation of research and construction towards the achievement of commercial flying. New types of problems should now receive consideration.

That of slow landings and the maintenance of control at low speeds is one that looms very largely. If slow speed can be obtained without loss of control, the safety of flying will be greatly increased. Planes will be able to land in smaller fields, and make a getaway in a very short run. Even with the establishment of landing fields or airports all over the country, emergency landings must still be made on occasion in restricted areas. Therefore the investigation of aerodynamic devices to permit of slow landings without sacrifice of high speed and carrying capacity is a fruitful field for research. Slow speed unfortunately means that the effectiveness of the control surfaces is diminished, since the forces they exercise vary as the square of the speed. In the case of the ailerons for lateral control the position is still more difficult since at slow speeds and large angles of incidence the ailerons become completely inoperative or even offer a reverse control of the most puzzling and dangerous character. The aerodynamics of control surfaces therefore deserves the most serious attention.

The airplane cannot be solely a fair weather craft. It must be capable of flying in all weather conditions, particularly at night or in a dense fog. The design of airplanes that can maintain a normal flight position under "blind" conditions therefore provides a wide field of research in stability. It is possible that even a stable airplane will have to have adjuncts for "blind" flying such as gyroscopic levels or stabilizers that must be perfected in theory and by laboratory investigation as well as by full flight tests.

The Problem of Propeller Design

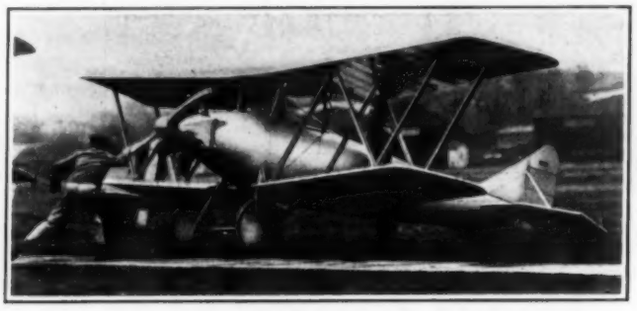
The stability of the airplane as a glider, i.e. with propeller at rest, is now well understood, but the interaction of the propeller slip stream with the stabilizing tail surfaces is still largely a matter of conjecture and further aerodynamic investigations are necessary.

The design of propellers for very powerful and high speed engines is difficult; under such conditions the tip speed of the propeller blades approaches that of sound and the aerodynamic values applicable for ordinary airplane speeds no longer obtain. At such high tip speeds the lift values drop off and the drag or

resistance values increase. Here again a difficult problem in aerodynamics has to be met.

The list of research problems such as the above could be continued at great length. Sufficient has been said to indicate that there is a large field to exploit.

To ask the airplane industry, which has to build and make profits, to undertake fundamental investiga-



A small scout plane with fiber fuselage

tions of this character is a little unfair. It is, however, quite within the province of the University laboratory to attack such questions.

To stress the most important lines of attack, to insure the maximum benefit for commercial aviation from the work of the Guggenheim School of Aeronautics, an Advisory Committee is being formed that will be representative of many elements of the industry. A number of eminent engineers have expressed their willingness to serve on this committee.

The establishment of the Research Laboratories is a matter deserving of as much thought as the planning of the curriculum of instruction, and one of the functions of this Advisory Committee is to advise in the design and construction of laboratories that shall be comprehensive and efficient.

The research laboratories will comprise first of all a larger wind tunnel than the one already available at the University, so that larger and more accurate models may be tested under conditions more closely approximating to full scale conditions. It is hoped to build a wind tunnel of some 64 sq.ft. in section and to obtain wind speeds of 100 miles per hour, with a powerful electric motor and propeller type of fan providing the motive power. This wind channel will be housed in a room of large dimensions, perfectly free from all obstructions, something like 100 feet in length and 30 feet by 35 feet in height and width so that the air stream in the wind channel may be as smooth and uniform as possible.

The airplane model in such a channel is submitted to conditions simulating those of full flight. An appropriate aerodynamic balance allows the forces of lift and resistance to be measured under every variety of flight condition. Moment measurements on special devices permit the workers in the tunnel to determine whether the airplane is stable under different conditions. Auxiliary apparatus will enable the airplane model to be tested as regards the effects of slip stream, whose importance we have already pointed out.

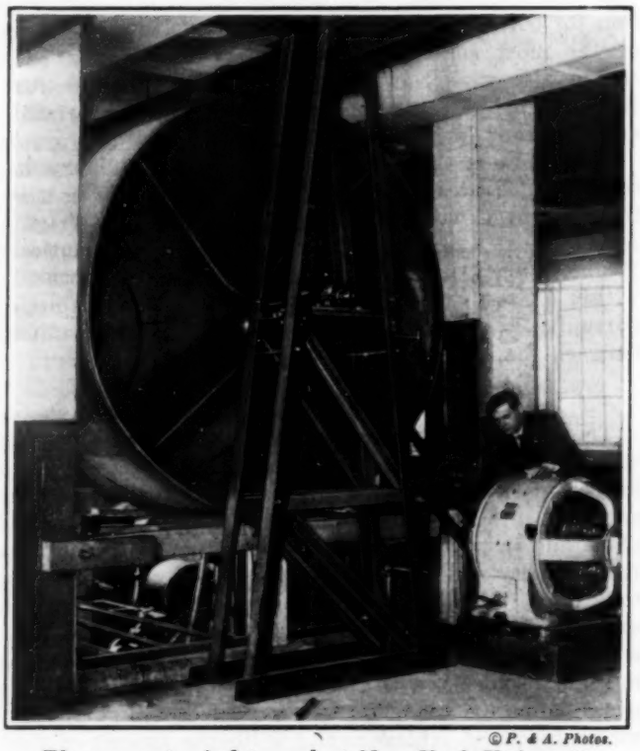
A special channel dynamometer will permit the investigation of airplane propellers to be made for the solution of the more difficult problems of propeller design.

Excellent methods of stress analysis already exist. But the structure of the airplane is a particularly refined one and it sometimes is advisable to check calculations by the testing to destruction of the first model of an experimental series. In such tests the full sized airplane is inverted and loaded with sand bags in accordance with the distribution of air pressures in full flight. In the Guggenheim School of Aeronautics suitable equipment for such tests will be provided in the Sand Test Laboratory, which will serve constructors and students alike.

The performance of aircraft and its carrying capacity always has a tremendous importance for the operator. To arrive at exact figures is not an easy matter. Constructors have sometimes in perfect good faith issued optimistic statements as to the performance of their craft, generally because in the construction of commercial types no disinterested source of information or station for testing existed. While the Guggenheim School of Aeronautics does not propose to operate a flying field or aircraft of its own, a full flight laboratory will be organized with all the necessary instruments and appliances and a measured course on Long Island whereby homologation of performance for manufacturers will be made possible. The full flight laboratory will also enable certain types of research to be conducted that will co-ordinate wind tunnel experiments with the performance and stability of full sized machines.

The instrument laboratory with its testing appliances will permit the investigation of the auxiliary apparatus that plays so important a part in the use of aircraft.

The Power Plant laboratory will permit the investigation of radiator and cooling problems generally. In



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The present wind tunnel at New York University

high speedships particularly the resistance of the radiator is an important percentage of the resistance of the entire airplane, and the determination of the cooling properties and aerodynamic resistance of various types of radiators and of air-cooled engines will be an important feature of the work of students in the School of Aeronautics. In the wind tunnel both the cooling and

the resistance of radiators can be quickly and exhaustively investigated.

While the construction of dirigibles is limited to a small number of concerns, yet the importance of individual units is much greater than in the case of the airplane. Therefore a dirigible laboratory will of necessity be included in the equipment. This will provide a water testing equipment, wherein an inverted gas bag of small dimensions filled with water enables the stresses and strains of a huge airship to be determined with exactitude. In the dirigible laboratory such questions as the diffusion of gases through fabrics, and the inflammability of gases will also receive attention.

The Research Laboratories will be in the hands of a skilled personnel. A very practical viewpoint provides for the services of a highly skilled mechanic and for the equipment of a special model shop. In aeronautics testing equipment is yet far from being standardized and most of the apparatus has to be specially designed and built.

The aeronautical research laboratories have also a bearing on other branches of engineering. For example, the wind pressure on buildings is usually calculated by means of antiquated and empirical formulas, which merit thorough revision in the aerodynamic laboratory. Windmills may be tested for power and efficiency under conditions simulating those of actual outdoor utilization of power. In other engineering fields aerodynamics plays an equally important and fundamental part.

The establishment of the Guggenheim School of Aeronautics may therefore not only have an important bearing on the advance of aviation in the United States but serve to advance a number of allied fields of engineering.

Drafting Changes

By John F. Hardecker

"Say, Jack," asked Bill, Chief Draftsman of a large manufacturing organization of his friend, "do you have much trouble with the increased cost of jobs due to changes? It just seems to me as though our engineers, and very often the Big Boss, or the customer himself, make changes which are really optional or matters of personal opinion, and they sure do run up the drafting time and costs." "Why, yes," agreed Jack, "I guess that's something we'll all have to contend with in some degree, but I'm using a stunt that's sure cutting down on them."

"Well, let's have it, because any help is sure a lot of good," said Bill.

"I have each draftsman thumbtack a card headed 'Delays' right above his job," replied Jack, "right where everybody can see it. Whenever his design is changed by his superiors, he makes an informal entry of the date, the time lost in making the change and the name of the man responsible for it. Of course, if it's an error on his part he must charge it to himself.

"In my daily rounds to the boards, I note these entries and question the draftsmen and if I'm satisfied with their conception of the responsibility, I initial them. You know, after one of the engineers sees his name there two or three times with the time lost alongside of it, he makes mighty certain of the positiveness of his decisions, and looks into the matter thoroughly before he requests a change. You'd really be surprised at how much time we've saved on jobs since we've been using this system."

Seen and Heard

By John R. Godfrey

Just what is "Finish"?

In the old days when Ohio was the far West, and Pittsburgh the outpost of the machine shop frontier, we used to speak of a "Pittsburgh finish" as "a high polish with deep scratches." Those days have gone and Pittsburgh needs no defense or apologies when it comes to workmanship. Perhaps it never did. But there are still cases where the "high polish and deep scratches" seem to be in vogue, and if we can believe the sales department, largely because the customer demands them.

I've run across several cases during the past year or two that make me think the buying public needs a lot of education as to what good finish really is. It's very much like the days when we turned up a piece of work in a lathe and then finished it with a file. It was more nearly round before we filed it, but we liked the looks of it better afterward.

Then came the grinding machine that made a few sparks like a young Fourth-of-July and left the work more nearly round and with a finish that rivaled the file and abrasive-cloth polish. Later developments in grinding machines made it possible to eliminate the finishing cut and relegated the latter, that backbone of the old machine shop, to a roughing machine. And the finish was so far ahead of the old file and abrasive days that we were happy for a time.

Whether or not the war demand for gages and for recuperator, or recoil barrels, that had ice backed off the map for smoothness, is responsible for the present trend toward lapping, is hard to say. At any rate it's here. And in some cases at least it is a doubtful improvement, for much that passes as lapping is only a return to the old abrasive cloth so far as its effect is concerned.

Taking a certain ball race for example, we find it is carefully ground on a good grinding machine and the race finished so that it is presumably true. But in order to get a higher polish the race goes to another machine where the operator takes a stick with abrasive cloth over the end, and proceeds to "finish" it. Judging by the strength exerted, he does. For we know his strength cannot be exerted evenly, and that while the surface is brighter, it is not as true as before.

In a similar way, a maker of balls for bearings claims that he has to polish the balls after they come from his finish-grinding machine in order to sell them. The polishing is done by tumbling the balls in sawdust and scraps of leather. And while there is but little abrasive action in the tumbling, it isn't hard to imagine that some such action does take place. Even the maker believes balls would be better just as they come from the last machine, after, of course, cleaning them thoroughly so as to remove all the abrasive.

It's very much as the works manager of a plant producing one of the finest automobiles in the world told me about connecting rod and crankshaft bearings. "We bore them and ream them with the best machines, with the best tools and with the greatest care. And after we do that, we don't let any mechanic, no matter how good he is, dig holes in them with a scraper."

Some customers demand a high polish—others want scraper marks. In many cases neither provides the best finish where accuracy and long life are concerned.

Ideas from Practical Men

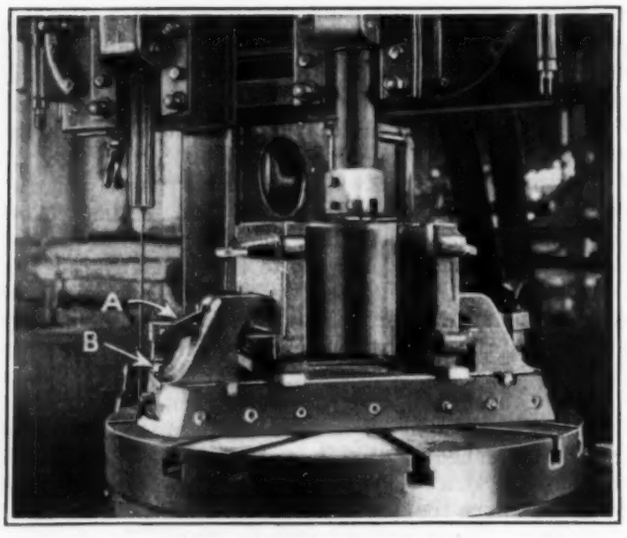
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Driving-Box Chuck

BY ROBERT BRAINARD

The device shown in the illustration was designed to hold driving boxes for locomotives on the table of a boring mill. The base is designed to hold two independent jaws in which the job is held.

Each jaw is slotted to allow for the movement of the lever *A*. By turning the adjusting nut shown at *B*, the



Chuck for driving boxes

operator can raise the outer end of the lever which forces the jaws to clamp the work solidly. The jaws may be adjusted so that they will clamp with their faces square with the job. The entire construction is substantial and admirably fitted for service as a boring mill chuck. Special jaws may be designed for the work needed and they may be used in the same base.

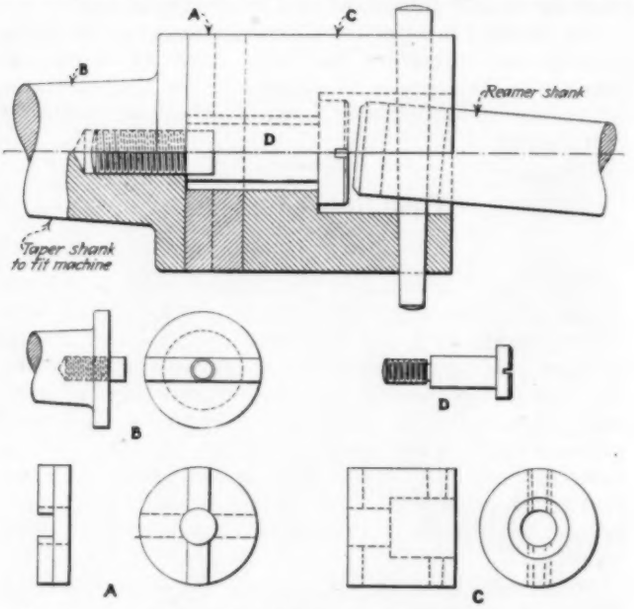
A Full-Floating Reamer Holder

BY H. L. WHEELER

The floating reamer-holder shown in the drawing was designed for use in a turret lathe and it has proved superior to others I have seen, for accuracy and reliability. The holder is made with interchangeable noses, so that several may be on hand to accommodate reamers of different sizes, without the necessity of having a complete holder for each size.

The holder is made in three sections of machine steel, pack-hardened and ground. The piece *A*, between the shank and nose, is a floating driver having a slot on the back side, fitting over a corresponding projection in the shank *B*. On the opposite side of the driver there is a projection that fits a corresponding slot in the nose *C*. There should be about 0.010-in. side-play between the projections and slots.

The nose is held in place by the screw *D*, passing through a central hole in the nose and driven into a tapped hole in the shank. A taper pin is used to hold the reamer, which is drilled through the shank. The pin should have plenty of freedom in the hole in the reamer shank. The screw holding the assembly, must bind against its shoulder, leaving enough room under



Floating holder for reamers

the head to prevent the floating driver from binding when the screw is set up tight. The hole through the center of the driver is $\frac{1}{8}$ in. larger than the screw.

This type of holder resists all tendency to bind in any direction, insures alignment of the reamer, and is especially efficient when reaming long holes.

Preventing Foot Accidents

BY H. ELLSWORTH

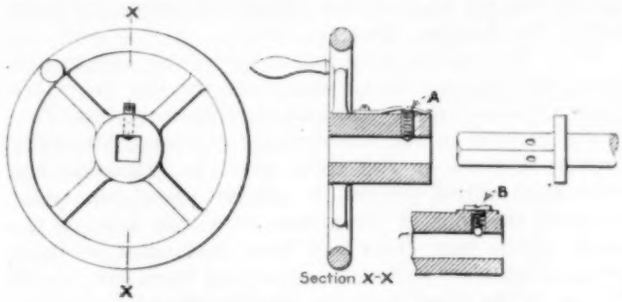
It is a well-established fact that among the most frequent accidents in shops are those occurring to the operators' eyes and feet.

In the effort to prevent our liability to foot accidents

IDEAS FROM PRACTICAL MEN

the arrangement shown in the accompanying sketch was tried and found most effective.

It will be recognized as a handwheel found on standard slotters and some vertical milling machines. On slotters it is used on the squared ends of the operating shafts and screws that are placed close together for the



A handwheel that will not jar off

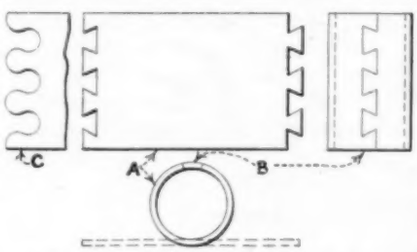
convenience of the operator. Wear eventually occurs and the wheel becomes quite loose, and is liable through the jarring of the machine to work off and fall to the floor, or on the workman's feet.

The squared ends of the shafts are spotted as shown to allow the spring plunger *A* to enter. A steel ball, held down by a spiral spring, as shown at *B*, may be used in place of the spring plunger. This will entirely cure the hazard if care is used to push the handwheel on until the plunger, or ball engages one of the spots.

A Lock-Seam Bushing

By W. B. Burr

The sketch herewith shows a method of producing a bearing shell or bushing for light work. It is strong and can be cheaply made. Referring to the sketch, it will be seen that the bushing is made from sheet or strip stock, and with the arrangement of dovetails or "locks" as shown at *A* there is no loss of metal after one end has been punched, because the punching out of the tongues on one end automatically provides the locking space for the tongue on the opposite end.



Bushing made of sheet metal

By rolling up the blank on an arbor or mandrel and locking the dovetails as shown at *B*, the bushing is formed. A light soldering or "sweating" at the joint-line is desirable to hold the joint rigidly. If an accurate job is desired for precision work, the bushing can be reamed to size, then mounted on an arbor and turned.

Another form of dovetail or lock is shown at *C*, which avoids any sharp corners and in some respects is stronger. This design is suitable for any of the ductile materials available in strips or sheets such as bronze, brass, steel aluminum, or tin.

Jig for Babbitting Locomotive Crossheads

By C. G. Williams

One of the big jobs in a railroad repair shop is that of keeping the crossheads of locomotives in condition so that the slapping will not pound the bolts loose, break the guides or tear them from the back cylinder-head or guide yoke. On some roads there has been an attempt to reduce the amount of work necessary to keep the crossheads in repair by the use of gun iron for the shoes, but it has not been found altogether satisfactory for the reason that the wear on the guides is excessive and they have to be planed about once every three months if both crossheads and guides are to be kept in good condition.

By far the best method known to the writer is to rebabbitt the crosshead whenever necessary, by removing it from the engine and placing it in a jig specially designed for the purpose. The use of the jig renders it unnecessary to plane the newly babbitted surfaces,

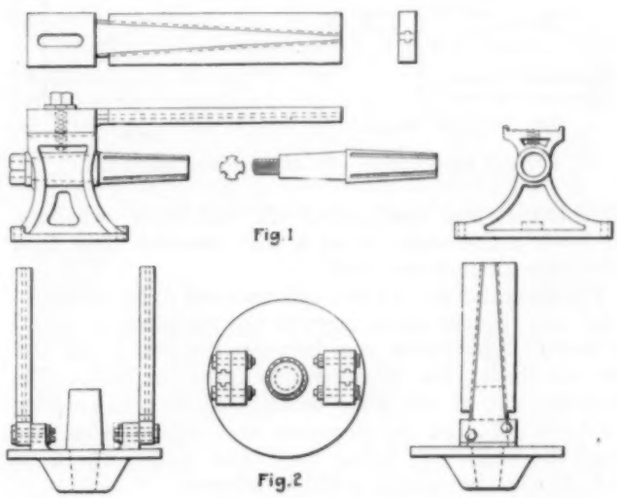


Fig. 1—Crosshead babbitting-jig designed by the writer. Fig. 2—A similar jig in use on another division

and the saving from this source amounts to at least one dollar for each crosshead so handled.

In Figs. 1 and 2 are shown two babbitting jigs, the first having been designed by the writer and the other being in use on another division of the road. In each case the jig consists of a base with a tapered tongue and two tapered bars, and a short mandrel having one end tapered the same as that on the end of the piston rod. The taper of the tongue and bars of the jig in Fig. 1, is such that a movement of both bars along the tongue a distance of 1 in., will increase or diminish the width of the combination babbitting-guide by $\frac{1}{8}$ inch.

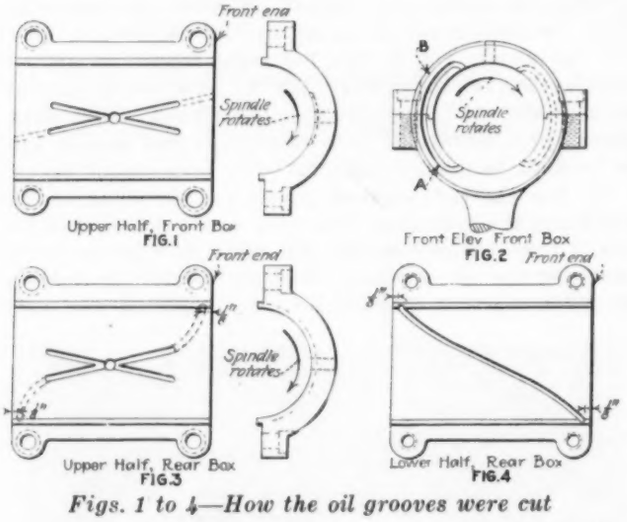
The sole advantage possessed by the jig in Fig. 2, is that both sides of a crosshead can be poured at one setting. With the jig as at present constructed there is, however, an outward spring of the tongue—causing some trouble at times—that is absent in the first example.

IDEAS FROM PRACTICAL MEN

Curing Hot Bearings

By W. B. Gardiner

One day when passing through the factory my attention was called to a cutter and reamer grinder that had hot bearings. The bearings had been giving trouble for some time and the man in charge of repairs had been trying to eliminate the trouble by cleaning the



Figs. 1 to 4—How the oil grooves were cut

oil channels and readjusting the end-thrust washers. He made a thorough job of it and installed sight feed lubricators, but to no avail.

The machine was of the conventional type, equipped with split, bronze boxes screwed tighely together, metal to metal. The pulley was between the two boxes and the end thrust was taken on the front box only. The machine was at this time being used as a production machine, grinding the clearance on reamer blades, and since the work was being done with a cup wheel, no end play in the spindle could be allowed.

I had the caps removed and found the oil grooves of the conventional type—two grooves in the form of a letter X, with the point of intersection directly under the oil hole. The grooves terminated some distance from the ends of the boxes, and were, of course, inadequate for oiling the end thrust in a bearing that had no end play.

The machine ran clockwise, so in the cap of the front box, I had the right-hand spiral groove continued to the edge at both front and rear, as shown in Fig. 1 by the dotted lines. The heavy lines indicate the original grooves. I had a similar groove cut in the lower half of the box.

Having the cap placed in position on the lower half of the box with the spindle and thrust washers in place, lines were scribed on the ends of the box to show the outside diameter of the thrust washers. Removing the spindle and replacing the cap, the grooves in the upper and lower halves of the box were connected by grooves on the ends, as shown at *A* in Fig. 2, care being taken that the connecting grooves were within the outside diameter of the thrust washers, as shown by line *B*. Note particularly that the connecting groove on the end of the box shown—front or wheel end—is on the left and the connecting groove on the other end on the right.

With these connections made, there was now a continuous groove completely around the spindle, all parts of which advanced in the direction in which the spindle rotated. This was important, for by the rotation of the spindle the oil was carried along the groove to every part of the bearing, thrust included.

Since the rear bearing took none of the end thrust, there was no need for oil outside of the box, therefore the continuous groove was entirely within the box.

The grooves in the rear-bearing cap were originally similar to those in the front one. In extending the right-hand spiral groove, a quicker spiral was used bringing the ends of the groove to within $\frac{1}{8}$ in. of the edges of the box, front and rear, making it at these points a complete half circle extending from one side of the box to the other, as shown by the dotted lines in Fig. 3. The ends were connected by a spiral groove through the lower half of the box, as in Fig. 4. With the parts assembled, there was now a continuous groove around the spindle, entirely within the box.

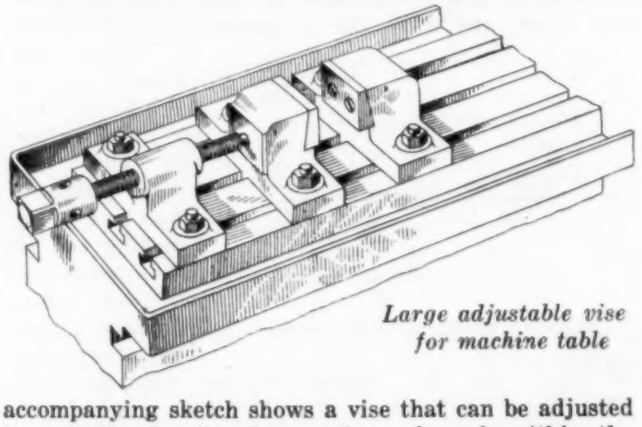
Half round grooves were used throughout and the front edges were not rounded at all.

In this special case, after making the changes in the method of oiling, the machine ran continuously, all day, day after day, and week after week. It was run on the minimum amount of oil and the bearings never overheated, neither did the spindle throw oil.

Large Vise for Milling Machine or Planer

By Charles Forst

The vise is perhaps the handiest and most common means of clamping work that is to be milled or planed, but the range of most vises is so limited that they are available only for comparatively short pieces. The



Large adjustable vise for machine table

accompanying sketch shows a vise that can be adjusted to suit the length of any piece of work within the capacity of the machine.

The sketch needs little, if any, explanation. The jaws are made of any length desired—not, of course, to exceed the width of the machine table—and are each provided with a rib to fit the central T-slot and bolt-holes to correspond with the outer slots. False jaws can be fitted, as shown, if desired.

The bracket, in which is the nut for the vise screw, is also ribbed and provided with bolt-holes. The manner of setting up and using the vise is obvious.

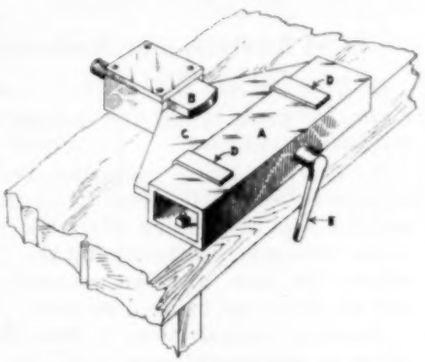
IDEAS FROM PRACTICAL MEN

A Bench Straightener for Small Work

By Donald A. Hampson

There are countless articles and devices that are labelled "handy" and the sketch shows a further addition to the list. It is a straightening device for small stock and is invaluable where accurate parts are produced in steel, and where cold-drawn flats, in particular, must be made more than commercially straight.

It is a home made affair only because there was nothing listed that filled the bill, and the shop that uses this device wanted something more efficient than the larger straighteners intended primarily for shafts and such work.



A small straightener

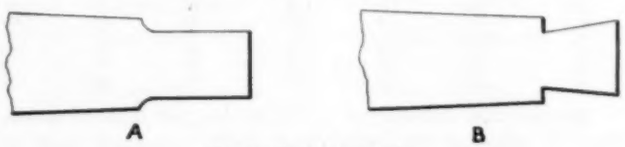
The body is a casting *A*, which is bolted to the bench and extends back to where a sliding nut has its upper part guided in a planed way, an extension of the nut appearing as the ram *B*. The surface at *C* is planed true and it is here that the work pieces are laid. The bent pieces *D* act as anvils and may be placed anywhere along the vertical edge, being set according to the bend in the particular piece being straightened. A handle *E* turns the screw and provides the necessary pressure.

The straightener is used on rounds as well as flats and rectangles, the latter up to one inch square. The surface *A* is machined and serves as a surface plate upon which to check the parts being corrected. With everything needed convenient to the workman, that most disliked job—straightening—is made very easy. The device is convenient to operate and where pieces of commercial cold-rolled steel have to be straightened within the thickness of a piece of tissue paper, it is hard to beat.

Screwdriver Points

By Richard C. Tarr

The point on the common or garden variety of screw driver is a delusion and a snare. The edges are so inclined as to make it almost certain the point will



Screwdriver points

slip out of the screw slot as soon as twisting force is exerted.

If the point is filed or ground so the edges are parallel, as shown at *A*, the screw can be driven home without danger of the screwdriver slipping and marring the edges of the slot.

If the screw slot is wide enough, the point of the screwdriver may be made as at *B*. In this case the extreme edges of the point will tend to bite into the sides of the slot. It will also be found that to drive a screw with a screwdriver pointed as at *B*, will take much less effort, in that heavy pressure in line with the screw will not be required. The greater the resistance of the screw to turning, the tighter the screwdriver will hold.

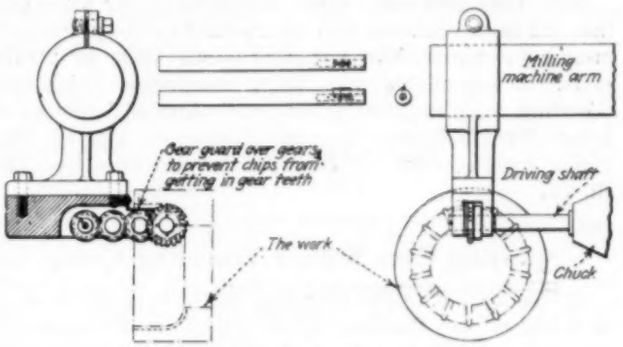
Fixture for Milling Slots in Dies

By K. O. Ames

Making dies for cold and hot molded materials, sometimes requires unusual fixtures, one of which is described herewith.

The piece to be molded required a series of semicircular projections equally spaced around the outside. The die itself was made of a non-shrinkable die steel. The slots were cut with the cutter attached to the fixture as shown.

The fixture is very simple. The supporting frame was made of cast iron and the auxiliary frame for carrying the gears and cutter was made of flat, cold-rolled steel. The gears through which power was transmitted to the cutter were made of machine steel, each running on a $\frac{5}{8}$-in. steel pin. The first gear in the train was keyed to the driving shaft. This was done



Fixture for milling internal slots

by inserting the key in the shaft below its surface. The shaft and gear were then assembled. By screwing in the cone pointed setscrew as shown in the detail in the upper part of the illustration, it forced the key in to the keyway of the gear and formed a solid unit. The cutter was made of high-speed steel and after hardening was pinned to the last gear in the train. A small guard was placed over the last gears, as shown. This prevented dirt and chips from getting into the teeth of the gears and causing damage. It will be noted that the cutter works in the inside of the upper part of the piece, thus allowing the chips to drop away from the mechanism.

The work was held and trued up in the usual manner in the chuck of the dividing head. Light cuts only can be taken, since heavy cuts will be liable to cause damage to the outfit. Various shapes have been milled with this device in internal dies, and also on external dies that required an extension beyond shoulders.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Satisfaction Guaranteed in Contracting

Q. Can you give me references of decisions at law on "Satisfaction guaranteed" in the performance of contracts?

A. According to the weight of authority in this country, the term "Satisfaction guaranteed" is not an absolute condition in a contract.

If a contractor agrees to perform satisfactorily for the promisee, it is usually considered to be qualified by the phrase "if the promisee uses his honest judgment." *Silsby Manufacturing Co. vs. Chicago*, 24 Federal Rep. 893.

Another point is that the promisee must give fair consideration to the question of his satisfaction. *Sidney School Furniture Co. vs. Warsaw School District*, 130 Pa. St. 76.

A refusal to examine the contractor's performance or a rejection of it based, in reality, not on its unsatisfactory nature but on fictitious grounds or none at all, will amount to prevention of performance and so excuse it. *Richardson vs. Coffman*, 87 Iowa, 121.

New York and many other states go so far as to say that the term "Satisfaction guaranteed to the promisee" means no more than a performance such as would satisfy a reasonable man using reasonable judgment. *Gladding vs. Montgomery*, 20 Calif. App. 276; *Fuchs & Lang Manufacturing Co., vs. Kittredge*, 242 Ill. 88; *Union League Club vs. Blymyer Ice Machine Co.*, 204 Ill. 117.

Spotting Cars With a Traveling Crane

Q. We have a 15-ton traveling crane on a 50-ft. span in a bay of our building which runs at right angles to the railroad siding. We have installed a snatch-block in the track and are using the crane for spotting cars. How much of a load can we expect to move with the travel motor on the crane? This motor is of 10 horsepower.

A. You cannot reasonably expect to move any dragging load, outside of the crane itself, with the travel motor. This motor and its gearing are designed to provide sufficient torque, with a fair margin, to move the crane carrying a capacity suspended load but it was emphatically not designed to drag a load on the ground.

If you attempt such a practice it will only be a matter of time, and not very much time, before the best-built crane will have worn-out bearings, a strained bridge, a distorted travel-drive shaft, trucks and tracks out of line, and a burned-out motor. This practice in fact will put the crane in bad condition more quickly than any other form of deliberate abuse.

Put another snatch block in the floor below a convenient position for the crane and use the load hook, if the crane must be put to this service, and a drag cable that will break before the crane hoist is overtaxed. It will take longer to move the car, perhaps, but more cars will be moved with that particular crane.

Steel Analysis and Mechanical Qualities

Q. How can you explain that steels of the same analysis, but made by different processes, vary so much in mechanical qualities?

A. The mechanical properties are dependent on the process as well as the analysis of the steel. Oxidation and the heat of refining affect the result. The nature of the atmosphere surrounding the steel, the slag which covers the bath, and the container holding the steel will all affect the finished product.

Chemical analysis alone is, therefore, not a conclusive index of mechanical properties, and should be used in connection with the other standard means of determining quality and characteristics.

Pressure Limits for Force Fits

Q. We desire some data relative to common practice in force-fit work on locomotive wheels to axles and similar work. The fits will in some instances be steel to steel and in some cast iron to steel. Please furnish us this data in size range from 3- to 8-in. fits.

A. There is a good deal of information on this subject published in the *American Machinists' Handbook* and similar hand books under the heading of drive and force fits.

Supplementing this information the following lists are set down as representing present practice in the shops of one of the leading railroads.

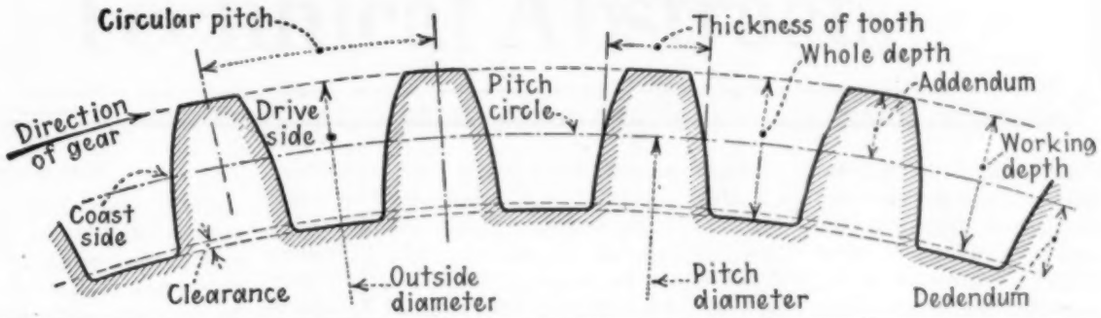
Pressures to be used in mounting locomotive axles, driving and trailing, and crank pins in wheels with steel and with cast-iron centers, measured in tons:

Dia. of Wheel Fit	Steel Centers			Cast-Iron Centers		
	Min.	Prefer.	Max.	Min.	Prefer.	Max.
4	58	64	80	36	40	48
4½	65	72	90	40	45	54
5	72	80	100	45	50	60
5½	79	88	110	49	55	66
6	86	96	120	54	60	72
6½	94	104	130	58	65	78
7	101	112	140	63	70	84
7½	108	120	150	67	75	90
8	115	128	160	72	80	96
8½	122	136	170	76	85	102
9	130	144	180	81	90	108
9½	137	152	190	85	95	114
10	144	160	200	90	100	120

An average allowance of 0.0025 in. per inch of diameter is allowed for steel and 0.0021 in. per inch of diameter for cast iron to result in these pressure tabulations.

The point must be kept in mind that the nature of the finish on the two surfaces in contact will have a decided effect on the pressure required to complete the fit.

Rules for Calculating Spur Gears



Having	To Get	Rule	Formula
Diametral Pitch	Circular Pitch	Divide 3.1416 by the Diametral Pitch	$P' = \frac{3.1416}{P}$
Outside Diameter and the Number of Teeth	Circular Pitch	Divide Outside Diameter by the Product of .3183 and Number of Teeth plus 2	$P' \frac{D}{.3183\ N + 2}$
Number of Teeth and the Circular Pitch	Pitch Diameter	Continued Product of the Number of Teeth, the Circular Pitch and .3183	$D' = NP' .3183$
Number of Teeth and the Outside Diameter	Pitch Diameter	Divide the Product of Number of Teeth and Outside Diameter by Number of Teeth plus 2	$D' = \frac{ND}{N + 2}$
Number of Teeth and the Circular Pitch	Outside Diameter	Continued Product of the Number of Teeth plus 2, the Circular Pitch and .3183	$D = (N + 2)\ P' .3183$
Circular Pitch	Thickness of Tooth	One-half the Circular Pitch	$t = \frac{P'}{2}$
Circular Pitch	Addendum	Multiply the Circular Pitch by .3183 or $s = \frac{D'}{N}$	$s = P' .3183$
Circular Pitch	Working Depth	Multiply the Circular Pitch by .6366	$D'' = P' .6366$
Thickness of Tooth	Clearance	One-tenth the Thickness of Tooth at Pitch Line	$f = \frac{t}{10}$
Circular Pitch	Diametral Pitch	Divide 3.1416 by the Circular Pitch	$P = \frac{3.1416}{P'}$
Outside Diameter and the Number of Teeth	Diametral Pitch	Divide Number of Teeth plus 2 by Outside Diameter	$P = \frac{N + 2}{D}$
Number of Teeth and the Outside Diameter	Pitch Diameter	Divide the Product of Outside Diameter and Number of Teeth by Number of Teeth plus 2	$D' = \frac{DN}{N + 2}$
Outside Diameter and the Diametral Pitch	Pitch Diameter	Subtract from the Outside Diameter the Quotient of 2 Divided by the Diametral Pitch	$D' = D - \frac{2}{P}$
Number of Teeth and the Diametral Pitch	Outside Diameter	Divide Number of Teeth plus 2 by the Diametral Pitch	$D = \frac{N + 2}{P}$
Pitch Diameter and the Number of Teeth	Outside Diameter	Divide the Number of Teeth plus 2 by the Quotient of Number of Teeth divided by the Pitch Diameter	$D = \frac{N + 2}{\frac{N}{D'}}$
Pitch Diameter and the Diametral Pitch	Number of Teeth	Multiply Pitch Diameter by the Diametral Pitch	$N = D'P$
Outside Diameter and the Diametral Pitch	Number of Teeth	Multiply Outside Diameter by the Diametral Pitch and subtract 2	$N = DP - 2$
Diametral Pitch	Thickness of Tooth	Divide 1.5708 by the Diametral Pitch	$t = \frac{1.5708}{P}$
Diametral Pitch	Working Depth	Divide 2 by the Diametral Pitch	$D'' = \frac{2}{P}$
Diametral Pitch	Whole Depth	Divide 2.157 by the Diametral Pitch	$D'' + f = \frac{2.157}{P}$
Diametral Pitch	Clearance	Divide .157 by the Diametral Pitch	$f = \frac{.157}{P}$

The stub form of tooth is designated by two figures, such as 4/5, which represents that the tooth is 4 pitch but cut to a depth of a 5-pitch tooth. These gear calculations are figured accordingly.

Aug. 6, 1925
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Punch here to suit your binder

Trim Line

Technical Abstracts

A Lathe Dynamometer

A. Sahnazaroff in *Zagreb* describes a comparatively simple device for measuring the pressure on the tool in the lathe. The tool is supported in a pivoted holder, the outer end of which rests on a piston. This piston is carried on a rubber diaphragm in a cylinder. Below the diaphragm, the cylinder contains glycerin. The pressure on the glycerin is read on the gage. The article gives the precautions to be taken in filling the cylinder with glycerin and gives formulas to be applied in evaluating the readings of the device.—*Die Werkzeugmaschine*, May 15, p. 254.

Endurance Properties of Metals

D. J. McAdam, Jr., of the United States Naval Engineering Experimental Station, discussing what fatigue failures mean and how they are brought about, points out that they are not caused by crystallization but by gradual failure. The important point in this article is that until very recently chief attention has been given to investigation of the effects of a range of stress between equal positive and negative values in steel alone. Only within a very recent period has definite knowledge been obtained of the endurance properties of non-ferrous metals. The article is largely tabular and graphical giving the result of experiments made on a rotating cantilever specimen.—*Mechanical Engineering*, July, p. 566.

Plant Location

John A. Piquet points out that the penalty of locating a plant in the wrong place is high freight tariff, labor trouble and inefficiency or poor service to the market. A recent canvass of the leading industries discloses the fact that in almost all cases the location of the plant was the founder's home town. However, a fundamentally sound location is at the strategic point of the particular industry, between market, material, power and labor. This site is a firm foundation upon which executives may make their future plans with confidence.

The founder seldom considers plant location. The question is instead delegated to the future operators to whom fall the problems of operation.

The executive of one large industry is quoted as stating that a small plant can be established locally at a reasonable investment and with a very small overhead, so that the large plant at a distance cannot compete in price. The distant plant is at a disadvantage especially in service, since the small plant can deliver overnight, while the large one must depend upon parcel post, express or freight. This system of regional plants that serve a particular market, and give quick service to the consumer is being adopted by many lines of industry. Freight costs are also cut. This is true in the automobile industry where it is found wise to locate assembly plants at different points where they can also act as warehouses and service stations.

Instances are given of other industries and of locations centered in the vicinity of New York.—*Industrial Management*, June, 1925, p. 330.

Aluminum Paint

Junius D. Edwards, assistant director of research of the Aluminum Co. of America, points out that metallurgical plants are presented with a peculiar problem in securing a paint that will withstand the severe conditions demanded of it. Foundries, for instance, are often dark and poorly lighted, savoring of the technical darkness from which they have, as a whole, emerged. Aluminum paint, in part a metallurgical product, is doing much to remedy these conditions. To foundries this paint brings good lighting with improved efficiency and economy.

For metallurgical plants, aluminum paint has a special interest, not only because of its brightness, but because of its remarkable protective properties. It will stand up under conditions where many paints fail.

The aluminum paint is made by mixing aluminum bronze powder with a suitable vehicle such as spar varnish. The aluminum imparts to the paint many desirable qualities. In the first place, it provides a bright and highly reflecting surface that increases the lighting efficiency in any room covered with it. Aluminum paint shows remarkable durability because the aluminum particles are not transparent. The opaqueness of the aluminum helps to protect the vehicle beneath from the destructive action of sunlight which is one of the worst enemies of paint. It shows very satisfactory resistance against the sulphur-containing gases that escape from furnaces and the like. This paint will not turn black nor discolor in the presence of these gases as do the white lead paints.—*Iron Age*, June 11, p. 1715.

Conveyor Furnaces

W. Trinks studies the labor saving appliances that can be used in industrial furnaces. Generally speaking the conveyors may be classified into chain conveyors, belt conveyors, roller conveyors, car-type conveyors, monorail conveyors and helical conveyors. The chain type is very popular and gives very little trouble at temperatures below 1,200 deg. F., but at 1,600 deg. F. the chain type causes trouble unless it is specially designed and well cared for. The other conveyors mentioned in the above classification are described very fully with details as to their advantages and disadvantages. The illustrations help to explain the types.

Material to be heated can be delivered to a furnace by an external chain conveyor which automatically deposits the stock on the furnace chain. Several illustrations of this type are given. There is also a complete description of the rocker-bar type which is next in popularity to the chain furnace. The rocker bar type is well suited to transporting materials through a furnace if the temperature is below that at which scale is formed.—*Fuels & Furnaces*, July, p. 683.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Who Does the Buying?

THE question as to who does the buying of the particular thing he has to sell is one that every salesman must be able to answer before he is completely successful. Offhand, the answer naturally is the buyer, or the purchasing agent. But a little study will show that this is not the whole story.

An engineering survey of the functioning of a big department store brought out the fact that every salesman and saleswoman that had any ambition aspired to be a buyer. The position of buyer was looked upon as the last word in authority and importance. In merchandising, the exchange of goods for cash is the ultimate end toward which the whole enterprise is striving. Goods are purchased in quantities at wholesale prices and disposed of individually at much higher prices, the spread between the two prices serving to pay the cost of merchandising and provide the desired profit. The people involved in the transaction are not producers. They add value to the product by their services in making it available to the consumer but that is all.

A different situation exists in the manufacturing plant. Raw materials, speaking generally, are purchased by a purchasing agent, value is added to them through the manufacturing process and the finished article is sold by the sales department or by other distributors. So far the two cases are similar.

The company must also buy equipment with which to do the work that adds value to the raw material and here the purchasing agent does not figure in the majority of up-to-date plants. No responsibility for the manufacturing results rests on his shoulders and he therefore has nothing to say about what equipment shall be used. That responsibility lies with the superintendent and he is the man who decides what machinery shall be purchased.

The supreme position of the superintendent in equipment purchases is brought out by the articles now running in the "Machine Tool Dollar" series in the "American Machinist." In each case the superintendent, or someone in a corresponding position, specifies what to buy and when to buy it. The salesman of industrial equipment will therefore do well to study this answer to his everpresent question and guide himself accordingly.

Redesigning for Profit

IT IS quite generally admitted that it is as easy to see faults in the other fellow's design as it is difficult to see them in our own. For this reason it is frequently good business to hire an experienced designer to go over our machines and point out possibilities of improvements. Even if he cannot improve them the money is by no means wasted. In fact, it is cheaper than as though we had to make changes in designs and fixtures. And, incidentally, it flatters our vanity a bit also.

There will be very few cases, however, where improvement and simplification cannot be pointed out. In one case that comes to mind the designer was able not only to reduce the cost so as to put the balance on the right side of the ledger, but also to improve the machine from every point of view.

The advisability of bringing in outside experience has always been a subject for controversy. On one side is the argument that no outsider can know the reasons for certain details of a machine like those who have been brought up with it. But, although this always has a plausible sound, experience has proved that it does not work out that way. In too many cases, however, the alleged reasons for awkward and expensive designs are merely excuses for inability to produce something better.

Those who have worked with a device from the beginning are not in as good a position to see chances for improvement as an outsider. He brings experience gained in many lines and can usually adopt methods from other industries that are unknown to us. There are many instances where profits depend on the reduction of costs as much as on increased volume and here the experienced designer is a valuable man to consult, and to engage to look over the work.

There are not many such designers who are free to handle the business of any firm, but it might be a good thing for the industry if a few more were available.

Just Suppose

JUST suppose a man undertook to build automobiles without any idea as to what the tires and bodies were going to cost him. And suppose further that he decided to put his car in competition with that of a manufacturer who used much cheaper materials and workmanship in his bodies and equipped his cars with an inferior grade of tires.

How long do you suppose that man would stay in business? Of course people would buy his cars but the more they bought the more money he would lose and it wouldn't be long before he would be broke.

Theoretically a man has a right to conduct his business at a loss if he wants to but it is hardly ethical for him to do so when he kills the market for everyone else by setting his prices on insufficient data.

It's going to be hard to eliminate this foolish practice, but—

Just suppose

Shop Equipment News

Springfield Toolroom Lathe

The toolroom lathe which is being built by the Springfield Machine Tool Co., 631 Southern Ave., Springfield, Ohio, is available for the market in two arrangements of drive. It can be furnished with a single-pulley drive, as illustrated in Fig. 1, or with an individual motor mounted inside of a housing that is cast integral with the pedestal, as illustrated in Fig. 2, below the headstock end.

In the motorized design, a pivoted base is used to support the motor and to provide adjustment for the belt through which the motor drives the machine. This adjustment is made by manipulating a screw within the hinged door at the back of the pedestal housing. A larger hinged door at the end of the housing is provided with louvers for ventilation and is set for a means of access to the motor.

The driving pulley, in either case, runs free on a wick-oiled bronze bearing and is equipped with a Carlisle-Johnson friction clutch for transmitting power to the geared head. Either an a.c. or a d.c. motor can be used and arranged for push-button control if desired.

Twelve spindle speeds in geometrical progression are obtained by means of 14 gears in the headstock, which run in a bath of oil. All of the bearings in this headstock, with the exception of the main spindle journal, are equipped with radial ball bearings for thrusts as well as loads. The spindle bearings are arranged with sight-feed oilers.

Operation of the friction clutch on the driving pulley of the belt-driven machines may be accomplished through the handle at the right-hand side of the apron or through an overhead push rod. This clutch pulley is arranged with a self-oiling device that need be supplied with oil but once a week. A friction arrangement permits stopping the lathe instantly upon throwing out the clutch.

The gear box is an additional feature on lathes built by the company. It provides 36 feed changes for cutting threads from 1 to 56 per in., including pipe threads of 11½ and 27 threads per inch. Feeds ranging from 1 in. per 5½ spindle revolutions to 1 in. per 308 spindle revolutions are obtainable. All of the gears in the feed box are of steel drop-forgings.

At the left-hand end of the machine there is a housing which incloses the change gears used in cutting the pipe threads. Transposing gears may also be used to change the feeds from the English to the metric system. Other details of the machine are similar to past designs.

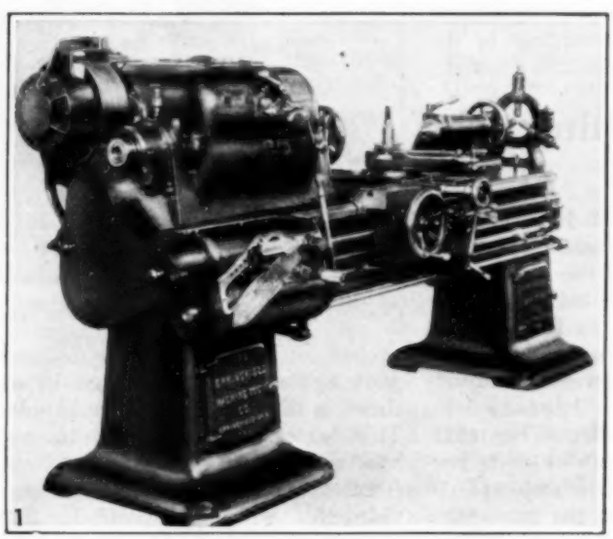
It is being built in 14, 16, 18 and 20-inch sizes.

Norwalk Compressor Type TB-S4T

The Norwalk Co. of South Norwalk, Conn., has brought out a line of multi-stage compressing machinery for air and gases. The machines are built in four capacities, ranging from 50 to 250 cu.ft. per min. displacement and pressure up to 5,000 lb. per square inch.

The compression end of the machine consists primarily of but one cast-iron cylinder shell, which, together with its end heads, incloses four stages. It is attached in tandem to a standard Norwalk power end.

The first- and second-stage cylinders are of the differential type in which the first-stage cylinder is single acting, with compression toward the frame end, while the second-stage cylinder is an annular ring formed around the trunk piston by the difference in diameters of the first- and second-stage cylinders. It also compresses toward the frame end on all of the sizes in the line.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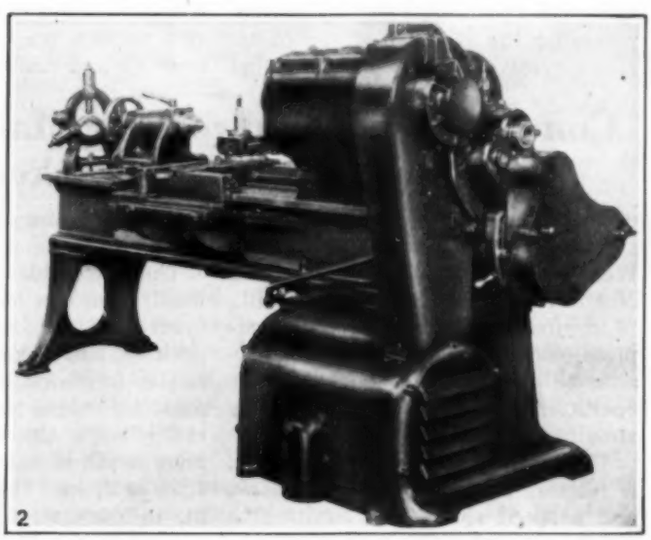
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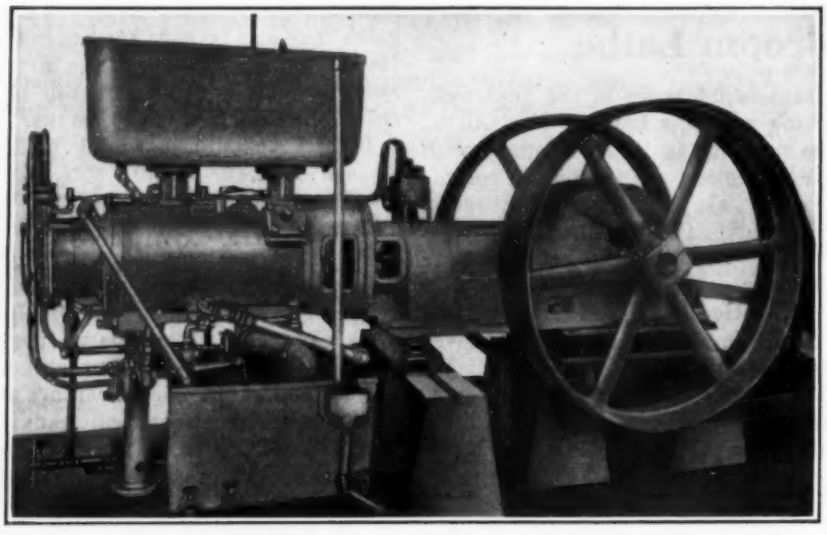
Fig. 1—Springfield Toolroom Lathe. Fig. 2—A rear view of the same machine with motor-drive mounting

SHOP EQUIPMENT NEWS

The outside head of the second-stage cylinder forms a secondary shell in which both the third- and fourth-stage cylinders are contained.



Norwalk Compressor, Type TB-S4T

The third-stage cylinder consists of a cast-iron bushing, pressed into the second-stage cylinder head, while the fourth-stage cylinder is a tool steel bushing, made integral with its head, and carefully machined, hardened, ground and polished.

The third- and fourth-stage cylinder heads are surrounded by an open tank to provide cooling by complete submergence. The end half of this tank is removable to provide access to the third- and fourth-stage valves.

All valves in this machine are of the Norwalk ring-plate type and are interchangeable, an intake valve becoming a discharge valve by merely reversing the position of the parts. Non-corrosive metals, such as monel or manganese bronze, are used, since they are best suited to the special service to which the compressor is applied. The valves are constructed so that, in the event of breakage, no parts can enter the cylinders.

Intercoolers between each stage and an aftercooler are provided. The coils are all located in large open-top tanks. The compressor is designed to render all parts readily accessible to inspection and repair. Removal of the third-stage cylinder head exposes the interior, and through this opening the complete assembly of all four pistons may be removed.

The floor space required ranges from 44x128 in. for the smallest to 60x150 in. for the largest machine. Power required to drive ranges from 18.5 to 97.5 b.hp. according to the capacity and final pressure desired.

Combination Woodworking Machine Co. Simplicity Woodworker

The simplicity woodworker designed and built by the Combination Woodworking Machine Co., 153 North Desplaines St., Chicago, Ill., is in effect an assembly of five complete machines in one and is adaptable to many useful woodworking operations, either one at a time or simultaneously.

The machine includes a saw table, a jointer, a planer, a boring table and a speed spindle, in addition to which a number of special attachments are available. The first four units are arranged so it is possible to use them simultaneously.

The saw table to the left in the illustration can be tilted to a maximum of 45 deg., or any intermediate position, and locked securely. There is also provision for vertical adjustment by means of a handwheel located below the table. The maximum depth of saw cut which is possible is 2¾ in. The saw measures 10 in. in diameter and the saw table measures 19¾x28 inches.

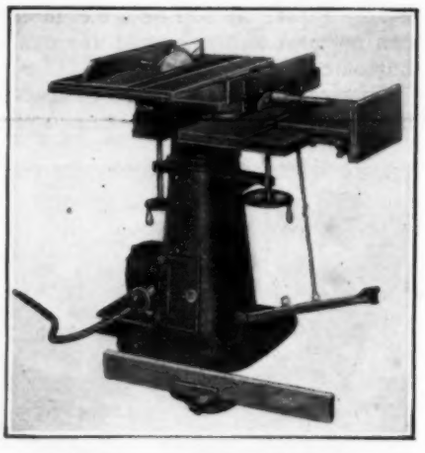
The jointer table, which is arranged above the cutter head in the center of the machine, has the usual means of adjustment vertically for both the front and rear tables and is arranged in addition for the attachment of extensions for extra long work in a similar manner to provisions which are made for the planer table.

A tilting fence on the right-hand side of the jointer table may be set and locked at any angle. 6½ in. is the maximum width of cut that can be taken. The table is 27¼ in. in length.

The cutter head of the round, improved safety type carries three knives made of high-speed steel. They can be adjusted as desired.

The planer table is located to the left-hand side and arranged so planing is done on the underside of the same cutter head working in the opposite direction than is correct for the jointing operations. This allows the two operations to be worked simultaneously without interference. The planer table is adjustable vertically from $\frac{1}{16}$ to 4 in. below the knives. The maximum width of cut is 6¼ in. The table itself measures 15½x26¾ in. Pressure rollers are provided to hold the work on the table while it is being planed.

The boring table is mounted on the side of the planer table to carry



Combination Woodworking Machine Co. Simplicity Woodworker

work against tools which can be secured in the end of the main spindle. This table measures 10x14 in. and has a standard travel of 3⅜ in. Greater travel distances can be provided for when so specified. The hole in the spindle measures ½ in. in diameter and a set screw is ar-

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ranged with it to secure the boring tool.

Finally, the end of the spindle is shaped for the attachment of a wheel for grinding tools, a mortiser, or a disk sander.

The one main spindle runs at 3,500 r.p.m. and is supported in three self-aligning, double-roll ball bearings which are fully inclosed and provided with lubrication.

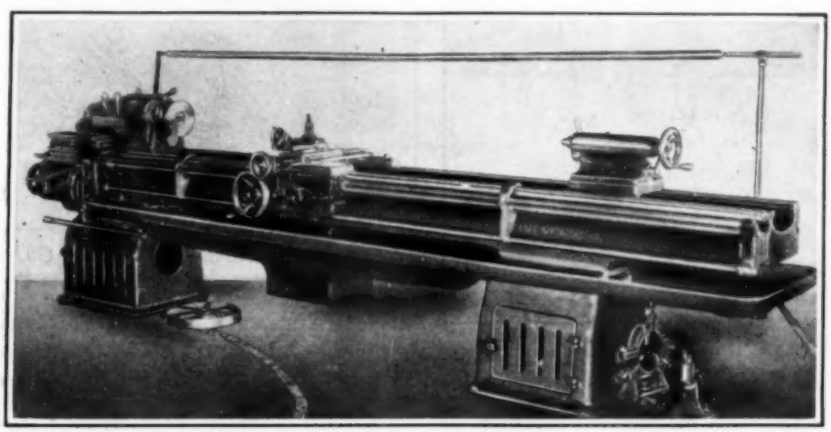
The machine is furnished, as specified, for belt or motor drive, with or without the recommended 1-hp. motor. In case the motor is specified, a platform on the side of the base is provided for setting it. Regular equipment includes the necessary wrenches, two cross-cut gages, a ripping gage and one fine-tooth, 10-in., combination cross-cut saw. The machine stands 37 in. in height, occupies 28x41 in. of floor space and weighs 550 pounds.

Pratt & Whitney Special Lathe, 16-In., Model B

The feature of the special Model-B lathe built by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., is in the extra-long bed which provides for a maximum distance of 120 in. between centers. Otherwise, the machine is a duplicate of the company's standard Model B.

The same headstock is constructed of the regular box-form construction and is said to preserve perfect alignment in the extra length. An extra-large cabinet leg is used to support the outer end.

Two special brackets, movable along the ways, have been added to support the lead screw and the feed and stop rods. These brackets are



Pratt & Whitney Special Lathe, 16-In., Model B

with the back gears beneath the spindle. The carriage and tailstock have not been altered. The bed is free to slide along the bed on the front way and contain half-bearings for the screw and the rods.

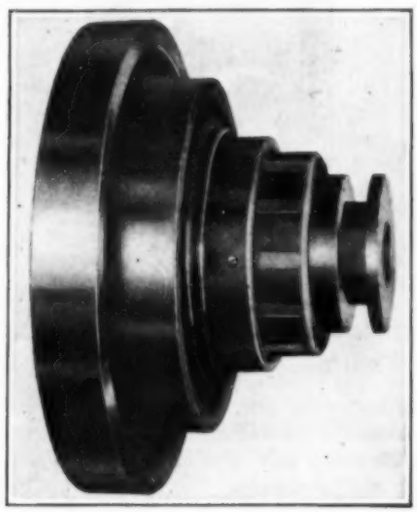
Edgemont Disk Clutch Type E

The Edgemont Machine Co., Dayton, Ohio, has brought out a Type-E line of disk clutches for use on machine drives that includes one, designed with a slotted cam, and one with the cam operated through the shaft. The clutch is available mounted inside of a pulley, a sprocket or a gear blank in either of the designs, and may also be had as an extended-sleeve clutch or as a cut-off coupling. The illustration shows the clutch-sprocket or gear-blank model with the slotted cam.

The Type E clutches are of the dry-plate design, equipped with woven asbestos, metallic liners, and consist essentially of a ventilated disk faced on both sides with the woven asbestos, two friction plates mounted one on each side of the disk, and a manipulating assembly consisting of levers that terminate in rollers inside of the shifting collar.

The levers may be adjusted by loosening the setscrew shown on the yoke in the illustration, and by turning the adjusting sleeve until the next slot is beneath the setscrew, which may then be tightened again. The asbestos liners are replaceable when worn.

The clutch is built in two sizes for transmitting 5 and 8 hp. respectively at a speed of 100 r.p.m. Pulleys up to 20 in. in diameter may be



Edgemont Disk Clutch, Type E

used in connection with the standard units, but mechanisms can be furnished for use with special pulleys or other applications.

The clutches may be had with Fafnir, transmission ball bearings, with oiler bushings of either cast iron or bronze, or with plain bronze bushings.

Trumbull Motor-Starting Switch

The Trumbull Electric Manufacturing Co., Plainville, Conn., has brought out an inclosed switch of the tumbler type designed especially for use on machines that are driven by fractional-hp. motors, or for heavy shop-lighting circuits.

The box is made of galvanized iron with a specially finished surface to prevent rusting, or it may be furnished in black enamel. There are $\frac{1}{2}$- and $\frac{3}{4}$-in. knockouts in each end of the box, as well as $\frac{1}{2}$-in. knockouts on both sides and at top and bottom of the rear, providing for wiring from any direction.

The lever is guarded to prevent it from being thrown by accident, and holes in each side of the guard provide for the use of a wire and seal,

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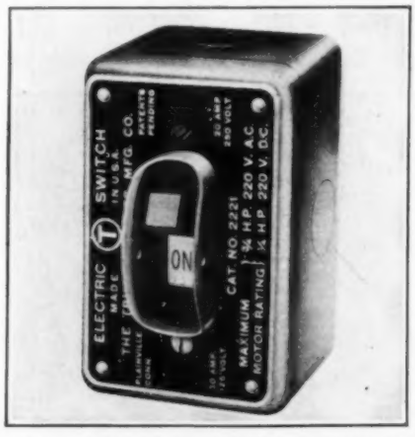
or padlock, to prevent it from being thrown by unauthorized persons. A plain index shows whether the switch is on or off.

The outside dimensions of the box are 2⅝x4x1⅛ in. The switch is made



Trumbull Motor-Starting Switch

to carry 20 amp. at 250 volts, or 30 amp. at 125 volts. It is made only in the two-pole type and may be used on single-phase or d.c. motors up to ¾-hp. capacity.

Haynes Stellite Gages

An addition has been made to the line of small tools manufactured by the Haynes Stellite Co., 30 East 42d St., New York, N. Y., in the form of a complete set of plug and ring gages for manufacturing purposes.

The plug gages are made in sizes ranging from ½ to 3 in. in diameter. Sizes smaller than ½ in. have removable gaging tips that are driven in

Haynes Stellite Gages

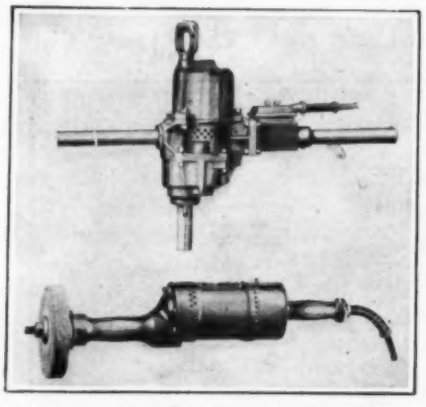
the body with a taper fit. Larger sizes are made so that the gaging portion is of ring form and held in place by a cap screw. The body is knurled to give a good grip while the gage is being used.

The ring gages, made in sizes from ½ to 3 in. in diameter, have an aluminum body cast integral and held securely by a grooved tongue on the stellite portion. Both types are made to standard tolerances and are finished to 0.0001 inches.

A test conducted by the Bureau of Standards is said to show a life for the stellite gages four to six times greater than that for steel gages under corresponding conditions. As stellite is a non-magnetic metal, composed chiefly of cobalt, chrominum and tungsten, metallic chips will not cling to its surface. The body of the gage is made of an aluminum alloy in order to reduce its weight to a minimum.

Chicago Pneumatic "Hicycle" Electric Reamer and Grinder

The electrically-driven reamer and the grinder illustrated have been developed and are being manufactured by the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., to take advantage of the greater power



Chicago Pneumatic "Hicycle" Electric Reamer and Grinder

possibilities offered by current of higher frequency than 60 cycles.

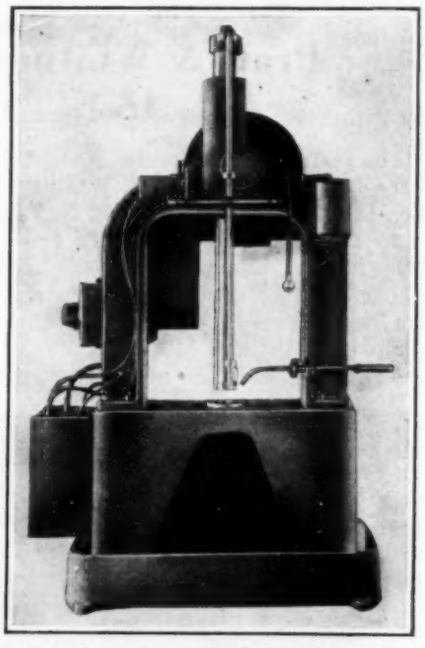
They are intended for general uses to which similar tools can be applied and are operated on a power circuit from a special motor-generator set which will deliver 180-cycle, 220-volt 3-phase current.

The driving motor is of the squirrel-cage type with the rotor wound with bar copper. Ball bearings are used throughout. The speed is 10,800 r.p.m. running free and is said to be 9,936 r.p.m. at full load.

The advantages claimed for this type of tool are increased power resulting from the high sustained speed, a lessening of weight as compared to 60-cycle tools of the same power rating and practically constant speed at all loads within the rated range.

American Broach & Machine Co. Vertical Broaching Machine

The American Broach & Machine Co., Ann Arbor, Mich., has added the vertical broaching machine of the push type to its other lines of similar equipment. The machine is intended to increase the capacity of the vertical line in being sufficiently



American Broach & Machine Co. Vertical Broaching Machine

large to furnish a 30-in. stroke and to develop a pressure of 20 tons. It will clear 30 in. between the uprights.

The drive is from a 7½-hp., 750-r.p.m. motor through a silent chain to a worm and wormwheel which connect to the ram through a pinion and a rack, cut on the side of the ram. The worm and rack pinion are of hardened steel, while the wormwheel is made of bronze. End thrust from the worm is taken on roller bearings. Working speed is 16 ft. per minute.

The movements of the machine are controlled electrically and are arranged so the downward stroke is started by throwing the motor-switch lever. At the bottom of the stroke an adjustable limit stop, attached to the ram, stops and reverses the driving motor.

The ram is 4½ in. in diameter and is fitted to receive a standard connecting bushing.

The machine occupies 5x5 ft. of floor space and weighs 4,000 pounds.

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Kempsmith Vertical and Universal Milling Machine Attachments

The vertical and universal milling-machine attachments illustrated in Figs. 1 and 2, respectively, have been developed by the Kempsmith Manufacturing Co., Milwaukee, Wis., for use on its lines of milling machines.

The vertical spindle attachment is especially designed for heavy-duty work on the maximillers, but can also be adapted to the cone-type machine by providing a different base and driving gear than those illustrated.

The head, which is graduated in degrees on its rim and which can be swivelled through a complete circle at right angles to the machine spindle, is arranged with four bolts for clamping it in a desired position.

A hardened spur gear, secured to the nose of the machine spindle, meshes with a gear on the drive shaft inside the attachment. Hardened-steel bevel gears connect this shaft to the spindle.

The spindle has a tapered front bearing and is adjustable in a tapered bronze box. It is fitted with a No. 12 B.&S. taper and terminates in the Kempsmith patented spindle nose which is designed to make all the tools interchangeable. A draw-in rod is provided to hold stub arbors.

The attachment is recommended for face and end milling, dovetail and T-slot milling, heavy die-sinking, large cam milling, short-lead spiral or thread milling and continuous rotary milling.

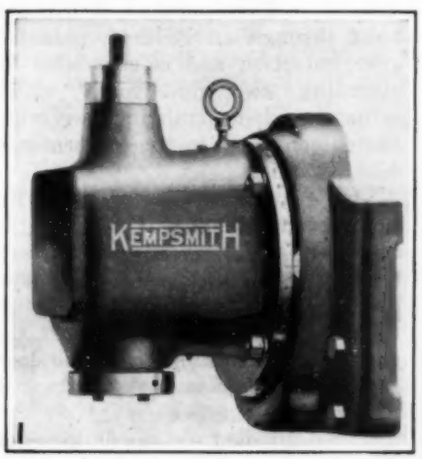
The universal attachment is illustrated in Fig. 2. The base is made in a number of sizes to fit the company's line of machines and is designed to clamp on the column ways. The body is held in place on the base by four T-bolts and is centered by a finished hub which bears in the the base. The clamping ring is accurately graduated to degrees on the outside diameter.

Mounted on the body in a plane at right angles to the column face is the spindle head. This has the same-diameter clamping ring as the body, is also centered by a large-diameter boss and graduated around the outside of the clamping ring.

The spindle is made of a heat-treated, alloy-steel forging and has a No. 10 B.&S. taper. It is also provided with a draw-in rod. All bearings and the taper hole in the spindle are ground after heat-treatment.

The spindle boxes are phosphor bronze, the front bearing being tapered and fitted with bearings to take thrusts in both directions. The spindle-driving gear is placed close to the front bearing to make possible the placing of cutters on the spindle almost directly under the center of the spindle head and to provide a support on both sides of the cutter.

The drive for the attachment is taken from a hardened-steel gear which is attached to the spindle nose in the same manner as a face mill would be. All gears in the driving train are of hardened alloy steel. The final drive to the spindle is through a pair of wide-face herring-bone gears. All of the bearings are furnished with phosphor-bronze bushings, accurately fitted.

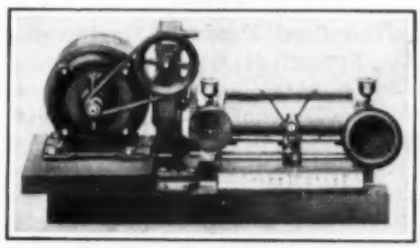


Figs. 1 and 2—Kempsmith Vertical and Universal Milling Machine Attachments

Allis Adjustable-Delivery Motor Drive for Alternating Current

The adjustable-delivery motor drive for alternating current has been developed by the Louis Allis Co., Milwaukee, Wis., for application to drives where a variation of speed through recurring small intervals is allowable, or even advantageous, but where an average speed for a period of time is desired.

The drive comprises three elements, the Louis Allis multi-speed a.c. motor, a revolving drum for establishing an average speed through a setting that will combine the correct proportions of different speeds during a short interval and contactors for switching to these different speeds as the rotating segments of the drum make changes in the circuits. The drum assembly is illustrated.



Allis Adjustable-Delivery Motor Drive for Alternating Current

It consists of a copper cylinder divided into segments that are insulated from each other by an air gap. The cylinder is mounted to rotate in bearings and is driven at an average speed of 1 r.p.m. by means of a fractional-hp. motor of the polyphase type.

On each of the segments there is a stationary brush which bears continually on that particular segment. The lead from each brush connects to one side of a contactor controlling one of the speed windings of the multi-speed motor. There are as many segments on the drum as there are speed windings in the motor.

Another brush is arranged so it can be moved across the face of the drum and set so it will contact with the different segments in turn as the drum rotates and the air gap passes under the brush. This results in breaking the circuit to one contactor and making it to the next, as one segment passes from under the brush

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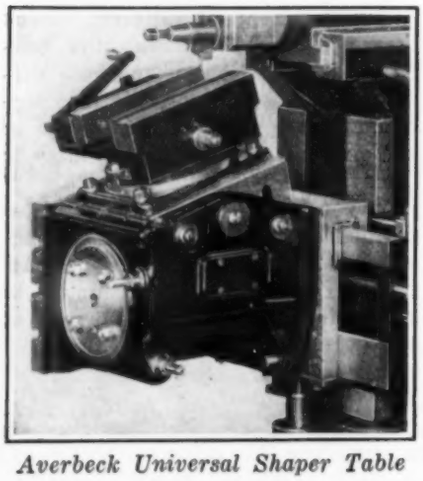
and the next one comes into contact with it. The air gap is designed so the interval of the total time the movable brush is on one segment is proportional to its distance from one end.

To protect the assembly, it is completely inclosed in a steel box through which the adjusting handle projects. Knockouts are arranged for the wiring. The contactors are also completely inclosed in another box and are provided with electrical and mechanical interlocks.

Averbeck Universal Shaper Table

The Steel Products Engineering Co., Springfield, Ohio, has developed and is marketing a universal table for use in connection with its Averbeck shaper, previously described on page 496, Vol. 59 of the *American Machinist*.

A wider range of tilting angles and a greater distance from the table to the cutting tool are possible, on account of the construction with the center trunion, than could be obtained with the tilting member hinged at one end and rested on a jack at the other, as was previously the design.



Averbeck Universal Shaper Table

The table is supported through its entire length on a heavy trunion, which is cast integral with the apron. A worm, mounted on a shaft at the outer end of the table below the trunion, engages with a wormwheel to turn the table on its bearings. Four clamping bolts at the outer end are arranged to secure the swivel at any desired setting, as determined on a graduated plate.

The table is provided with two working sides at 90 deg. with each other. One is a solid top containing T-slots, as on the usual table, while the other is designed to tilt by setting a rocking member into the main table. This second member can be tilted to 16 deg. on either side of the center, graduations on its side near the outer end indicating its position.

A sliding block engages a screw which is extended through the end of the main casting and terminated in a squared end to provide means for positioning the tilting member. Two bolts pass through the slots in the outer ends to the outside of the main casting and are used to clamp the working surface at any desired angle within its range.

There is an added point for convenience to the operator, in setting the main member, in a hardened and ground locating plug which engages holes in the apron for either of the two horizontal working positions.

Racine Sprue-Cutting Machine

The sprue-cutting machine, which consists of a base, a power hacksaw and an adjustable work-holding fixture, has been developed by the Racine Tool & Machine Co., Racine, Wis., for use in foundries. It is particularly useful on castings of special alloy and tool steel and will make a smooth, clean cut which requires practically no grinding.

The saw assembly is arranged so it can be tilted and held at various angles by rotating the handwheel shown to actuate a worm and wormwheel segment. The drive is from a motor or countershaft, as may be specified.

The work-holding fixture is designed so it can be moved in either direction and the faceplate rotated to bring the work to correct position.

Racine Sprue-Cutting Machine

Work of a similar nature can be mounted in groups, moved progressively under the saw, removed and replaced while the saw is in operation, thus saving time in quantity work. The machine has a capacity to cut 9 in. of metal.

Joslyn Electric Hoist

An electric hoist intended for use in garages, machine shops and similar places, where frequent lifting must be done not in excess of 2,000 lb., is being marketed by the Joslyn Manufacturing & Supply Co., Chamber of Commerce Building, Chicago, Ill.

The motor, which can be operated from either single-phase alternating current or direct current, drives the hoist through an inclosed, patented gear reduction and is controlled by operating two pull cords which actuate a self-neutralizing, reversing switch connected in the compensated field winding.

Joslyn Electric Hoist

The gearing, which provides for a reduction of 900 to 1 between the motor and the chain, is made of heat-treated steel and is said to be non-overhauling. This makes it possible to use a hook on either end of the chain, which is hung over the load sprocket, a time-saving feature. A brake is also unnecessary.

The equipment weighs 85 lb., with the exception of the load chain, and measures 18 in. in length by 10 in. at its maximum diameter.

News of the Week

Europe Not Ready to Buy Standard Types of American Machine Tools

Lack of credit facilities hampers present business

As a general statement, there is at the present time little or no interest shown by European machinery dealers in what is known as standard machine tools of American make, says Charles D. Oesterlein, president of the Oesterlein Machine Co., of Cincinnati. Mr. Oesterlein has just returned from an extended European tour which took him through England, France, Belgium, Holland, Germany, Austria and Italy. In each of these countries Mr. Oesterlein made a special study of conditions as related to the machine tool market and he has made some interesting observations.

"It is my conviction that American machine tool builders who have only standard types of machines to offer will have to wait patiently for two or three more years until the development, which is now in process, reaches a stage that will permit them to again sell," he states.

"It strikes me that precisely the same thing that is occurring here in the States is taking place throughout Europe. A great many new machine tool establishments have entered the field in the various countries. Present business conditions will not support all of them and in consequence there is severe competition; it is a case of the survival of the fittest.

Sixty Per Cent Cheaper

"Added to this, the American manufacturer must take into account the fact that European wages converted into dollars are only half to two-thirds of what we pay, and consequently the selling price of European machines generally is around 60 per cent of our selling price. I am convinced that in some instances it would be difficult to sell American machines if this differential were narrowed to the point where foreign prices were 90 per cent of American prices.

"Do you wonder that most dealers say openly that they are not interested in standard American machine tools?" asks Mr. Oesterlein.

"But how about the European builders of standard machine tools? Here there is apparently a mixed situation. It was a surprise to me to find any one of them actually busy, but a number of them are busy and at least one of the few in England on whom I called, is running day and night. Others in both England and Germany are running to capacity and are apparently sold out many months ahead.

"These more fortunate machine tool builders are the ones who make the better quality machines which compete with American makes. While the builders of high-grade machines are faring rather well, those building cheaper machines are falling by the wayside.

"Taken as a whole, it seemed to me that foreign machine tool builders are faring a bit better than American manufacturers. They are doing the lion's share of the European business today and can be expected to continue to do so until the level of European prices and American prices come fairly close together.

"The story is quite different when it comes to increased profit producing machinery of all kinds. Anything new, with a promise of turning out work sufficiently cheaper than by former methods on standard machines, will interest them. Furthermore, you have your choice of agents. Foreign production engineers are rapidly falling into step in adopting production machinery. Those American manufacturers who are now getting foreign business in any volume not only have improved types of machines for lowering the cost of producing certain parts, but are in the field with their own men doing engineering work and rendering various kinds of service to back an active selling campaign.

"Not all countries seem to be responding alike in the matter of taking up these new machines. In this connection, I was impressed by the contrast of the conservative attitude of the British manufacturer who has the credit available but seems more or less skeptical of things which are new; and the aggressive attitude of the German manufacturer who has the will to buy, but in many cases lacks credit facilities."

Liberal Credit Needed

On the subject of credits, Mr. Oesterlein has this to say: "Perhaps the most important pending volume of business could be released by making it possible for the willing Germans and certain others to buy our machines through the means of establishing credits for this purpose. This is not an individual manufacturer's problem — indeed it would be hazardous business for the manufacturer to undertake. There is no guaranty to the stability of the European situation as it exists today and in addition to this general insecurity there are the problems of the individual corporations. Economists employed by syndicates of bankers should be capable of formulating plans whereby suitable guarantees could be exacted and credit could safely be established in this country for this specific purpose.

"I think it is only a question of time when foreign costs and prices will very nearly reach American levels. We have nothing to fear, but everything to gain, through catering to our overseas friends and persuading our bankers to render such assistance as would be found practical in their own judgement after a study of these problems."

Screw Thread Commission Makes Further Report

In reporting to the National Screw Thread Commission, the sub-committee on bolt heads, nuts and wrench openings, of which Commander J. B. Rhodes is chairman, outlined several changes in its previous report. Among those changes the commission has approved the following:

An increase in the tolerance on width across flats. The tolerance on the rough product was increased greatly. The sides of the head and the nut may be tapered.

The finished product is to have the bearing surfaces washer faced.

The formulas for the respective products are to be omitted with the exception of that for the hex-head cap-screw.

Fine threads are recommended for like nuts only.

The oval crown on hex-head cap-screws was omitted.

The width across flats for the ¼-in. stove and machine screw nuts was increased to ⅜-in. from 7/16-in. This ⅜-in. width, however, makes the ¼-in. stove bolt nuts out of step with all the other ¼-in. bolt heads and nuts.

C. A. Young, director of standardization of the American Petroleum Institute, reported to the commission that distinct progress is being made in the standardization of oil well casing. Drill pipe probably will be limited to six sizes. All threads are to be eight to the inch, with ¾-in. taper, with the exception of the 2-in. which may be both eight thread and ten thread with a ⅝-in. taper. The Petroleum Institute has arranged for four sets of master gages. A master set will be deposited at the Bureau of Standards and one in each of the principal producing centers. These sets will control all threaded joints for well casing.

The preliminary report on the stud-fit investigation has been sent out to engineers in automobile plants and to other users of stud fits. They are urged to submit suggestions and criticisms. The proposals are being tried out in actual practice in many plants.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE aspect of business at present is more than usually dependent upon the glasses through which it is viewed. On the Stock Exchange nearly every one is wearing rose-colored spectacles and a bullish interpretation is given to most developments.

It is admitted that the public is heavily long of stocks, but it is pointed out that the margins required are unusually large. It is also admitted that seasoned bonds are slow of sale, but it is explained that preference is being given to the new issues brought out daily on exceptionally attractive terms. The lower wage scale announced by the New England woolen manufacturers has been adopted by several cotton mills, but it is urged that lower costs, increased production and a larger distribution will result.

So it goes, and the speculative shares have been bid up on every pretext, although it would not be precise to say that the stock market as a whole is much higher. On last Tuesday, for instance, there was a stimulation of bullish excitement when nearly two million shares changed hands, but the average of twenty industrial and twenty railway stock issues, as published by the New York *Evening Post*, showed little or no change. It is also to be observed that the present level is very near the top since 1921.

A trade review published a week ago said that "The influence of foreign iron upon the domestic market along the Atlantic seaboard has never been more glaring than at present. Just when the local makers are prepared to advance prices cheap foreign material interferes with their plans. Thus East Indian iron can be bought at $20 to $20.50 c.i.f. Philadelphia, which is the present base price at the furnace for the Eastern Pennsylvania makers." And on July 27 a telegram from Pittsburgh stated that "Foreign competition caused the Pittsburgh Plate Glass Co. to announce today a 25 per cent cut in the prices of its products, effective at once." The announcement reported large and increasing importations of plate glass from Belgium, France and England, and a decreased domestic demand at irregular prices.

Now we cannot eat our cake and keep it too. Therefore, it is not to be expected that we can continue to finance the world's industry and escape its competition. Nor would it be desirable for us if we could be internationalists in finance and exclusively national in our production and consumption of manufactured goods.

It is, however, important that we should realize that the shift from economic nationalism to internationalism will compel some readjustments that will be painful and certain to provoke protest.

Among them is a reduction in wages.

What's Doing in Industry

An unusual seasonal activity pervades the machine tool market at this time. Contrary to expectations, July was one of the best months of the year in volume of sales, and the number of new inquiries that have appeared on the market in the past week indicate that the next few weeks will see no noticeable slowing up in sales.

The demand for machinery and tools is spread over a wide territory, and no one particular type of machine is held in favor over another. The automotive industry continues to purchase tools for replacement and for the expansion of plants which is taking place prior to the announcement of new models. For this reason Detroit reports increased buying of special machines, and Cleveland, Cincinnati and Milwaukee report an active demand for machine tools for automobile plants in their respective territories.

The New York market has enjoyed one of the best summer business seasons it has experienced in a few years. June and July were better than all the other months of this year combined, and sales in the past week indicate that the volume will continue. The New England district, having had a protracted quiet spell, reports increased business, particularly from foreign sources.

The South noted an improvement in July, with better prospects for the coming month.

A general analysis of business in all lines all over the country forecasts no radical change. Reasonable activity may be expected for the balance of the year, unless foreign competition shall force a general reduction in wages or sales.

It may be that the downward revision will be confined to the cotton and woolen industries, but that would not be in accordance with precedent. Developments should therefore be closely watched, for although lower wages may be economically desirable they are sentimentally dispiriting and out of harmony with an advancing stock market.

But it must be admitted that the statistical record of the business now passing is at variance with the cautionary spirit of the foregoing. Railway traffic is immense. Gross and net earnings are large. Chain stores, mail order concerns and most of those who deal with the farmers report a large increase in sales, and cheerfulness is the predominant note. The higher rates of interest asked by the banks for loans on securities are as yet without any reflex in the condition of the Federal Reserve Banks, whose earning assets show no increase, and if there is anything more than a change in sentiment ahead it is a long way off.

Conditions in Europe are also better. Premier Baldwin is still wrestling with the threatened coal strike, but the British genius for compromise will probably avert it.

Caillaux seems to be achieving the impossible in disposing of his gold parity bonds, and the gold value of the franc is gradually rising.

The Polish zloty has been fluctuating wildly on rumors that Poland has abandoned her attempt to keep her currency on a gold basis, and Keynes is still assailing the re-establishment of the gold standard in England, but neither fact is very important.

Our domestic commodity markets have upon the whole been quiet. Wheat is somewhat higher, but the theory of a world scarcity seems to be untenable. Corn reflects the expectation of a large crop.

The cotton market was paralyzed by the last Government report. Speculators are afraid to trade, and there are but few buyers for the hedges that are being offered against the new crop. The result has been a decline. The market for cotton goods is correspondingly confused.

At the lower prices named by the American Woolen Co. at its spring opening an enlarged demand has been uncovered, but caution persists. The rubber boom appears upon the eve of an overdue collapse. The trade at the high prices recently quoted has been nominal.

But the direction of these various straws does not as yet indicate any radical change in the current of American business, and reasonable activity for the balance of the year seems probable unless foreign competition shall force a reduction in wages or sales.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

Business conditions in the local machine tool industry continue satisfactory, dealers reporting a fair volume of trade for July, with every indication that by September general activity will characterize the market.

A Chicago representative of a large manufacturing concern operating plants in the leading cities of the United States, stated that each month, from February to July of this year, business had been progressively better, and that he saw no reason to fear a reduction. In no case has the writer encountered opinions other than optimistic among members of the machine tool industry.

Railroads are still buying in small quantities to meet special requirements, the Chicago, Burlington & Quincy and the Illinois Central having within the last few days placed a number of orders.

The automotive industry, while not an active factor in this market, is still heard from with inquiries for tools needed for replacement purposes.

Cleveland

Business in all branches of the machine tool industry in Cleveland shows continued activity. Manufacturers report the closing of a good volume of sales for out-of-town customers while local agencies report business good in the local field. New inquiries are mostly for individual pieces and especially for small tools.

The demand for punching and shearing machines, which has been dormant for some time, is showing more activity and producers in this particular line believe that this condition will continue.

The city of Cleveland will award contracts in the near future for a quantity of small tools for its Municipal Light Plant.

Cincinnati

Cincinnati machine tool manufacturers report that in the past week the trend has been slightly upward. There is the usual seasonal tendency toward sluggishness with some concerns, but others report that they are quite busy.

A few manufacturers found business to be slightly spotty last week, but the majority stated that orders and inquiries received were evenly spread over different sections of the country. It was also reported that orders are evenly distributed as to types and sizes of tools.

The demand from the automotive industries diminished to a small extent, not because of dullness in that line but because some factories have temporarily shut down departments to make arrangements for next season's manufacture. The number of inquiries coming from this field indicate that buying will increase in the near future. Manufacturers of motor buses, it is stated, contemplate large extensions, because of the increased demand for these vehicles.

Railroads still are confining their buying to absolute needs, but more inquiries are coming from this source. A small amount of export business is reported, this being confined to special tools. There nave been many foreign requests for quotations, but the sales have not been in proportion.

Detroit

Increased buying of machinery and machine tools for the next month or six weeks is expected by leading representatives in the Detroit field. This expectation is based upon recent announcements of plant expansions, and the keen competition among automobile manufacturers which has created an exceptional demand for special machinery on the part of those executives who realize that lower production costs mean increased sales of the finished product.

The past two weeks have seen orders placed for considerable of the machinery and tools for the additions to the Dodge plant, upon which some eight million dollars will be spent. Packard continues one of the heaviest buyers of machinery. The engineers at the factory appear determined to have every machine automatic, and many types of machines, many of them new, are being delegated to the scrap heap in order to make way for other machines which can pay for themselves within 200 days or less.

The Ford Motor Co. is not buying on quite the scale it was a month ago. The new drop forge shop at the River Rouge plant has its full complement of tools, but the larger machinery has yet to be installed.

Hudson-Essex expects to add working shifts to increase production, instead of adding equipment. Heavy taxation, it is said, is one of the determining factors in this decision. Studebaker remains more or less quiet. Oakland's new line of cars has resulted in spotted purchases by the Pontiac factory. Buick, which is machined and tooled up to an output of 1,000 cars a day, is only turning out between 600 and 700 and there is little to expect from that quarter.

The $2,000,000 expansion program of the Wilson Foundry and Machine Co., of Pontiac, manufacturers of all Willys-Knight and Overland engines, is being rushed to completion so that the new units, with their new machinery and equipment, can be placed in use by September first.

As an indication of what may be expected in the near future one need only point to the fact that purchases of raw materials are showing a decided upward trend. Trades supplying the automotive industry are showing signs of increased activity and the aggregate tonnages of raw materials purchased this month will be substantially ahead of those purchased in June.

Milwaukee

General opinion with respect to trade in metal-working equipment is more cheerful now than at any time since early spring. There is active inquiry for various kinds of equipment, the automobile trade being most interested as a group. Railroad needs are coming out in small numbers but are not as important as earlier reports led manufacturers to believe.

Local demand for machine tools is moderately active, although with one or two exceptions, the real call is almost entirely for replacement. An exception is the A. O. Smith Corporation, which has been an active buyer of equipment for the past year and still has many items to purchase.

Some of this equipment is for the new department manufacturing pipe line specialties for the oil industry, although the automobile unit and parts division has also been undergoing expansion. The larger machinery manufacturers are getting more orders, but these are not taxing existing capacity.

Manufacturers, as well as dealers in metal-working equipment, are beginning to feel the effect of pressure on prices. This is now being heightened by the price cuts in the automobile trade. As a natural consequence, every other business is affected, and opinion is gaining ground that the coming few months will result in a gradual settling of the price structure, which will make for good business when the point of settlement has been reached

New York

Active buying of machine tools and machine shop equipment continues in this market, despite the expected seasonal slump that was predicted by many. July business proved to be far better than was anticipated, and this volume coming after the equally good month in June, has placed the local dealers in an optimistic frame of mind.

It has been variously estimated that the volume of business placed in June and July exceeded the total volume

placed during the first five months of this year. Many reasons are given for this rather unusual condition. The most logical seems to be this: Buying of all commodities was deferred in the first few months of the year because of fear of a business inflation; also many prospective buyers held off their purchasing in hopes that prices would drop. When neither of these conditions materialized those who needed equipment came into the market, and June and July received the business that should have been spread over more than a two-month period.

Railroads in particular have been prominent in the list of buyers during the past week. The building of new car repair shops and the replacing of old and worn out equipment has made it necessary for railroads to make long deferred purchases. The large list issued recently by the Mobile & Ohio continues to bring orders.

It is said that this list when completed will total nearly $200,000 worth of machine tools, and last week orders were placed in this market for a 90-in. journal turning lathe, a car wheel lathe, a side-head boring mill, a 48-in. x18-ft. planer, a 36-in.x12-ft. planer, a 100-ton bushing press and a 6-ft. plate bending roll. The Nickel Plate Railroad bought a large axle lathe and a 44-in. boring mill. The Atchison, Topeka & Santa Fe bought a car wheel borer. The New York Central Railroad placed orders for several pieces of equipment including a large pipe-threading machine, a vertical surface grinding machine, a toolroom lathe and a 48-in., 500-ton capacity hydraulic wheel press.

Industrials continue to place orders for special machines designed for high production work. Little activity is noted in standard types of machines, the present demand being for that type of machine that will assure more production at lessened cost.

New England

Analysis of balance sheets for the first six months of 1925, as compared with the corresponding period of last year, is occupying the attention of officials in machinery building organizations in New England. The conclusions drawn are that this year's business runs 15 to 20 per cent better than in 1924. Gross revenues are higher.

Coupled with the statements of improvement the first six months are those of present indications of a higher trend of business volume. This is especially so of industries affiliated with the automobile trade and special machinery builders.

Jugo-Slavia and Italy are largely represented in buying at the present time, the increase of trade from these countries attracting particular notice. Export business with Germany, France and England is favorable.

Philadelphia

The business outlook in Philadelphia continues to reveal satisfactory conditions, in the opinion of most manufacturers and jobbers. Machine tool dealers say that there is nothing to indicate a change from recent estimates when the forecast was for a gradual picking up of business.

Dealers in small tools have received many inquiries from prospective purchasers, and a substantial showing is revealed in the inquiries of the large manufacturers. Most of them are preparing for an active fall trade.

Five of the Delaware River shipyards, in the immediate vicinity of Philadelphia, have shared in the general increase in business. Orders for marine equipment have speeded up activity in these plants and new machinery is being sought.

The state employment agencies show industrial employment to be well above the levels which prevailed a year ago, and productive activity is also greater than it was at this time last year.

Southern District

Machine tool and equipment sales in the Southeast noted fair improvement the latter half of July, Atlanta distributors report, with inquiries active enough to promise that sales during August will continue to improve. July business as a whole was somewhat better than the corresponding month last year, while the latter half of the month showed a fair improvement over the first half.

Smaller shops and service stations are not doing so much buying right now, but inquiries from the latter are more active for used equipment

Textile demand is about the same, the outlook fair for the next two or three months because of the large amount of new mill construction. Sales to this source, however, are still below normal.

Some further buying by state highway departments and road building contractors is reported, as much new road construction is in progress in nearly all of the Southern states. This business has been unusually good so far.

Railroads are buying on about the same basis, with new inquiries fairly numerous. A number of new shop projects have been announced in the past three weeks, and heavier equipment sales will more than likely continue the rest of the year.

Industrial Engineering at Ohio State

E. A. Hitchcock, dean of the engineering department of Ohio State University, has announced the establishment of a course in industrial engineering as part of the new fall curriculum. This new department will be under the direction of John Younger, formerly chief engineer of the truck division of the Pierce-Arrow Motor Car Co., and chief of the engineering division of the Motor Transport Corps, and vice-president of the Standard Parts Co. Mr. Younger was for some time associate editor of *American Machinist*.

The engineering faculty of the university believes that students of engineering need a training in the fundamentals of production engineering and administration. The new course will embrace factory layout, grouping of tools and processes, time study and the design of proper fixtures.

Standards for Shafting and Keys Are Approved by A.S.M.E.

Two important dimensional standards dealing with cold-finished shafting, and square and flat shafting keys, recently approved as tentative American standards by the American Engineering Standards Committee, have just been published by the American Society of Mechanical Engineers, which has sponsored the study, and are ready for distribution.

The sizes covered are from ½ to 6 in. (machinery shafting), and 1⅛ to 5½ in. (transmission shafting). The recommended stock lengths for cold-finished shafting are 16, 20 and 24 ft. All the tolerances are negative and represent the maximum allowable variation below the exact nominal size.

The keys considered for these sixty standard shaft-diameters are either square or flat. The standard widths and heights and the corresponding negative tolerances are given. The keys are to be cut from cold-finished stock and are to be used without machining.

The standards for shafting and keys known as B 17a and B 17b respectively are the first dimensional standards having national approval to be published in this country in the single sheet form. They may be secured from the American Engineering Standards Committee, 29 West 39th Street, New York.

The sectional committee is now working on formulas to guide engineers in the selection of the best sizes for transmission shafting for use under various conditions for loading.

A Course in Motion Study and Practical Economics

The second course in motion study to be given by Mrs. Frank B. Gilbreth will start Aug. 31. Arrangements can be made with Mrs. Gilbreth for entrance to the 16-weeks' course, for which the fee is $1,000. Her address is 68 Eagle Rock Way, Montclair, N. J.

There will be from four to ten students, each to be sent by his plant, each to be thoroughly acquainted with his industry and capable not only of acquiring the technic of motion study but also of teaching it and making an installation.

The mornings will be devoted to lectures and conferences. These will cover the development of science in management, the growth of motion study, and some practical economics and applied psychology which are necessary in teaching in industry. Applications will be made in the field of selling as well as in the field of production. All aspects of scientific management that have to do with finding and installing better methods will be discussed, with special emphasis upon those that have a direct bearing on the special problems of those taking the course.

The afternoons will be devoted to practical instruction in motion study laboratory work in what Mr. Gilbreth called "The One Best Way to Do Work," considering the worker, surroundings, equipment and tools.

Personals

ROBERT J. ANDERSON has established himself as a consulting engineer, specializing in the metallurgy of aluminum, with offices at 221 Amber St., Pittsburgh, Pa.

LOREN EMERY has been appointed merchandising manager of the International General Electric Co.

GEORGE P. FISHER has been appointed works manager of the St. Louis Steel Castings Co., of St. Louis. He was formerly foundry superintendent for the Whiting Corporation, of Harvey, Ill.

BARNEY NELSON has been placed in charge of the forging division of the plant of Fairbanks, Morse & Co., at Beloit, Wis. He was formerly factory manager of the American Forge and Machine Co., of Canton.

E. W. ARNDT has been appointed manager of the foundry of the Joshua Hendy Iron Works at Sunnyvale, Calif.

ROLLIN H. WHITE has been re-elected president of the Cleveland Tractor Co., of Cleveland.

WILLIAM O. HOTCHKISS, state geologist of Wisconsin and a member of the Wisconsin Highway Commission, has accepted the presidency of the Michigan School of Mines, at Houghton.

FRANK H. CLARK, technical adviser to the Ministry of Communications, of China, with headquarters at Peking, is at present visiting and making studies in this country, staying at the Engineers' Club, at New York. Mr. Clark was formerly superintendent of motive power of the Baltimore & Ohio Railroad. He is preparing specifications and new designs for cars and motive power for Chinese government railways.

JOHN G. DAUN, who has been connected with the sales department of the Cincinnati Planer Co., of Cincinnati, Ohio, for the past eight years, has been appointed sales manager of the company.

CARL NERACHER has been appointed chief engineer of Durant Motors, Inc. Mr. Neracher will be assisted by George H. Robinson. Headquarters will be at the Elizabeth, N. J., plant.

ARTHUR JACKSON, of Toronto, Canada, has been appointed sales representative in Ontario and Eastern Canada for the Gibb Welding Machines Co., of Bay City, Mich.

R. W. GOTSHALL has been appointed vice-president and general manager of Monarch Tractors, Inc., of Watertown, Wis. H. B. Baker has also been appointed a vice-president and has been placed in charge of sales.

S. OLDFIELD is now in charge of the Societa Anonima Italiana Alfred Herbert, Milan, Italy.

ALEXANDER ANDERSON, formerly in control of the Alfred Herbert Italian organization, in Milan, Italy, is now in charge of the Manchester (England) office of Alfred Herbert, Ltd.

Business Items

The W. A. Jones Foundry and Machine Co., of Chicago, has established a branch office at 614 Builders Exchange, Minneapolis, in charge of F. S. Van Bergen. This office will serve the states of Minnesota, North Dakota, South Dakota, and parts of Iowa and Wisconsin.

The Federal Machinery Sales Co., of Chicago, has been appointed sales representative in the Chicago territory for the R. K. Le Blond Machine Tool Co., of Cincinnati.

The Russel Machine Co., of Pittsburgh, has established offices in the Oliver Bldg., in that city.

The General Parts Corporation, of Flint, Mich., has purchased the business of service parts of the Haynes Auto Co., of Detroit.

The E. F. Keating Pipe Bending and Supply Co. has been organized at Hartford, Conn. The company's plant at West Hartford has been equipped to manufacture power plant, piping, wrought iron pipe, steel pipe and copper tubing. Officers of the company are: E. F. Keating, president; H. K. Herbinson, vice-president; Charles J. Cannon, secretary. A New York office has been established at 452 Water Street.

The Hoopes & Townsend Corporation, of 1330 Buttonwood St., Philadelphia, has purchased the assets and business of the American Bolt Corporation and of the Hoopes & Townsend Steel Co. The various divisions of this corporation are as follows: The Hoopes & Townsend Works, Philadelphia; the Bayonne Bolt and Nut Works, Bayonne, N. J.; the Standard Bolt and Nut Works, Columbus, Ohio; the Michigan Bolt and Nut Works, Detroit, Mich.; and the Boss Bolt and Nut Works, Chicago. Justin C. Burns, president of the corporation, is located at the Philadelphia office.

The Kuhlman Electric Co., of Bay City, Mich., has appointed the Stevens Sales Co., of Salt Lake City, Utah, as district representative for the state of Utah and parts of Idaho and Nevada.

Obituaries

THOMAS H. FIRTH, head of the Brightside Foundry and Engineering Co., of Sheffield, England, died on July 16. He was fifty-four years old. Mr. Firth was an active member of British engineering societies and was prominent as a leader in the iron and steel industry.

JAMES W. GROVE, a director of the Verona Tool Works, and also of the American Nut and Bolt Fastener Co., died at Sewickley, Pa., on July 25. He was seventy-eight years old.

WARREN WOOD, president of the Wood Drill Works, Paterson, N.J., died on July 18.

R. HOLBROOK, proprietor of Holbrook & Sons, Stratford, London, E., manufacturers of lathes, died on July 7 in his 78th year. He had been in business about fifty years.

HARRY BINNS, of Binns Bros., Water Lane, Halifax, England, builders of machine tools, died on July 15. He was 45 years old.

JORGEN H. PETERSON, head of the Centaur Tool Works, Smethwick, Staffordshire, England, manufacturers of capstan and other types of lathes, screw-cutting machines, etc., died last month. He was 52 years old.

Trade Catalogs

Ball Bearings. The Standard Steel and Bearings, Inc., Plainville, Conn., has issued a booklet entitled "Lubrication of Ball Bearings Applied to Electric Motors." Drawings and descriptions of the SRB bearings are given and the methods of their lubrication as well as a lubrication chart.

Drilling Machines. The Avey Drilling Machine Co., Cincinnati, Ohio, has published a 40-page catalog of the Avey line of drilling machines and tapping attachments. Specifications and illustrations are given of each type of drilling machine as well as of the Avey-matics. Details of the machines are sketched and described completely.

Electric Wire. Bridgeport Brass Co., Bridgeport, Conn. A 15-page booklet has been published announcing the new Phono-Hi-Strength wire. This booklet also contains pictures showing the installation of Phono-electric trolley wire on several railway lines. There are many tables as well as technical data included in this booklet.

Grinders. The Hisey-Wolf Machine Co., Cincinnati, Ohio. Bulletin No. 1306 describes the "Hisey" 18-in., 5-hp. production grinder. Specifications for four styles of motor are given.

Die Sets. Danly Machine Specialties, Inc., 4911 Lincoln Ave., Chicago, Ill. A 46-page catalog, well illustrated, describes the processes and methods used in the manufacture of the Danly die sets and holders. Many types of sets are illustrated in the catalog, and the specifications in which each type may be obtained are given.

Set Screws. The Bristol Co., Waterbury, Conn. Bulletin No. 814 describes the Bristol safety set-screws with dove-tailed flutes. Screws with several styles of points are listed with the prices and specifications.

Radial Drills. The American Tool Works Co., Pearl & Eggleston Sts., Cincinnati, Ohio, has published Circular No. 315 to cover its line of belt- and motor-drive radial drills which are made in 3,- 3½- and 4-ft. sizes.

Pamphlets Received

Oxy-acetylene Process. Published by the Air Reduction Sales Co., 342 Madison Ave., New York City. The 20-page booklet "Answers to Questions about the Oxy-acetylene Process" is a concise little treatment of the principles and history of welding and the care and the operations of welding and cutting equipment.

Master Specifications. Published by the Bureau of Standards, Washington, D. C. Circular No. 233 gives the government specifications and requirements for Tuck's packing. Circular No. 234 lists the material and workmanship required for wire-insertion rubber packing. Circular No. 237 specifies the requirements for low-pressure, spiral-gland packing. Circular No. 238 contains the specifications for high-pressure, asbestos rod packing. Circular No. 240 names the government requirements for diaphragm packing. Circular No. 241 sets out the methods of inspection and the specifications for compressed asbestos sheet packing. Circular No. 243 details the requirements for asbestos metallic-cloth sheet packing. Circular No. 244 reports the Federal Specifications Board specifications, requirements and tests for rubber valves.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

American Gear Manufacturers' Association. Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Iron market is rather dull at present; prices holding firmly to last week's levels; Birmingham iron makers expect all furnaces to be in operation by September. Iron and steel scrap is gaining in strength. Features of this week's market are: the active demand for iron and steel pipe, bars, heavy rails, hot and cold rolled strips, blue annealed and galvanized steel sheets. Steel plates are about 5c. per 100 lb. above a week ago. Bars and shapes remain firm at July 24 levels; the former, $2 and the latter $1.85@$2 per 100 lb. at Pittsburgh mills. Plates range from $1.85 to $1.90 per 100 lb. at mill.

Non-Ferrous Materials—Copper, tin, antimony and lead are all higher than on July 24 at New York warehouses. Zinc is quiet with little tendency to change. Abrasives are advancing in the West while linseed oil is down.

(All prices as of July 31)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	19.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.10	3.50
No. 12	2.35@2.45	3.94	3.15	3.55
No. 14	2.40@2.50	3.99	3.20	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.00	4.15	3.70	3.80
Nos. 22 to 24	3.00@3.05	4.20	3.75	3.85
Nos. 25 and 26	3.05@3.10	4.25	4.00	3.90
No. 28	3.15@3.20	4.35	4.10	4.00
Galvanized				
Nos. 10 and 11	3.20@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.30@3.35	4.45	4.20	4.10
No. 16	3.45@3.50	4.60	4.35	....
Nos. 17 to 21	3.60@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.90@3.95	5.05	4.80	4.70
No. 28	4.20@4.25	5.35	5.10	5.00

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	....	4.@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	....	....
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¼c.; 1/8, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			60.00
Lead (up to carlots) E. St. Louis	New York 9.50@9.75		
Zinc (up to carlots) E. St. Louis	New York 8.12½@8.25		
	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.50	....	....
Copper sheets, base	21.75	22.25	22.25
Copper wire, base	19.25	21.50	20.25
Copper bars, base	20.87½	20.75	22.75
Copper tubing, base	23.75	24.75	24.25
Brass sheets, base	18.12½	18.62½	18.62½
Brass tubing, base	22.75	23.25	26.25
Brass rods, base	15.87½	16.37½	18.62½
Brass wire, base	18.62½	21.37½	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	11.25	10.25
Solder (½ and ½), (case lots)	39.50	37.50	40.00
Babbitt metal (83% tin)	60.00	68.25	60.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
		Cold rolled sheets (base)	50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.75@12.00	11.50	12.00@12.50
Copper, heavy, and wire	11.50@11.75	11.25	11.50@12.00
Copper, light, and bottoms	10.25@10.50	9.25	9.75@10.25
Heavy lead	6.00@6.25	6.25	7.00@7.50
Tea lead	5.00@5.25	3.75	6.00@6.50
Brass, heavy, yellow	7.75@8.00	6.75	7.00@7.50
Brass, heavy, red	9.25@9.50	9.00	9.00@9.25
Brass, light	6.50@6.75	5.75	7.00@7.25
No. 1 yellow rod turnings	8.00@8.50	7.25	6.00
Zinc	4.25@4.75	3.75	4.25@4.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.18
Cotton waste, colored, per lb.	.10@.15½	.18	.17
Wiping cloths, 13¼x13¼, per lb	.17@.17½	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.01	1.14	.95@1.00
Lard cutting oil, 25% lard, per gal.	.55	.50	.50
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	40%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	....
Second grade	50–10–5%	60–5%	....

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold finished shafting	per lb.	.0415	.0415	.0415
Brass rods	per lb	.1587½	.1587½	.14
Solder (½ and ½)	per lb.	.395	.395	.365
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (¼ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.45
Cloth	3.55	2.67	3.55
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.90@3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Stamford—School Comn., C. H. Martin—manual training equipment.

Mass., Brighton (Boston P. O.)—F. C. Hersee Co., 22 Parkman Ave.—equipment for the manufacture of automobile tools in new plant at Watertown.

Mass., Charlestown (Boston P. O.)—L. C. Page, 469 Rutherford Ave. — tools and equipment for repair and service garage.

Mass., East Boston (Boston P. O.)—A. Caponigro, 448 Saratoga St.—tools and equipment for repair garage.

Mass., East Cambridge (Boston, P. O.)—Viscol Co., 200 1st St.—dinking machine with stroke not less than 6 in. and block about 12 x 36 in.

Mass., Dorchester (Boston P. O.)—E. P. Galligan, 33-35 Gayland St.—repair tools and general equipment for extensive service garage.

Mass., Rosindale (Boston P. O.)—J. H. Morris, 66 Penfield St.—tools and equipment for repair and service garage.

Mich., Detroit—Dodge Bros., Inc., Jos. Campau Ave.—mechanical equipment for assembly plant.

N.Y., Brooklyn—Standard Kalomein Door Co., 235 6th St.—4 x 8 ft. veneer press in 4 sections.

N. Y., New York—V. Casella, 138 West 25th St.—14 in. screw cutting lathe.

O., Columbus—Big Mountain Coal Co., 20 East Broad St., P. A. Coen, Pur. Agt.—loading and unloading equipmnt for new retail yard at 22nd and Milsoff Sts.

O., New Philadelphia—Bd. of Education, A. A. Sternner, Clk.—machinery for manual training classes for proposed junior high school.

O., Youngstown—The Youngstown Foundry & Machine Co., 365 East Boardman St., 6 cranes, 25 ton lifting capacity.

Vt., Hartland—A. W. Martin—jointing machine and pony planer.

Wis., Green Bay—Northwest Engineering Works, Howard St.—1 crane.

Wis., Milwaukee—R. E. Stoelting, Comr. of Public Works—24 in. motor driven swing lathe with 10 to 12 ft. bed, 20 x 24 in. shaper, 3 hp. pedestal type electric grinder, etc.

Wis., Muscoda—Muscoda Mfg. Co.—(furniture manufacturers) J. Biba, Pur. Agt.—woodworking machinery.

Wis., North Milwaukee—P. Schmidt & Co., 33rd and Harrison Sts., P. Schmidt, Pur. Agt. (cut stone)—power saws for cutting building stone.

Wis., Shawano—Shawano Lumber Co.—saw mill machinery to replace fire loss.

Ont., Baden—J. L. Forler—equipment for saw and planing mills to replace fire loss.

Que., La Sarre—Letourneau & Lambert (saw mill)—band saw, single saw and other equipment.

Que., Quebec City—J. W. Cantin, 462 St. Joseph St.—heavy stand veneer press, etc.

Que., St. Anaclet—A. Lineau—swing off cut saw and band saw.

Que., St. Camille—E. Lacroix—drum saw, planer, etc.

Opportunities for Future Business

Calif., Los Angeles—Bd. of Education, awarded contracts for the construction of a 3 story Mount Vernon Junior High School including shops, etc. and a 1 and 2 story Edison Junior High School with 1 story manual arts building, etc. Also plans the construction of a 3 story, 168 x 184 ft. John Adams High School including mechanical shops, etc. Estimated cost $280,000, $303,000 and 200,000 respectively.

Calif., Sacramento—K. C. B. Electric Mfg. Co., 14th Ave. and 42nd St., is having plans prepared for the construction of an annex to plant for the manufacture of storage batteries at 42nd St. and 14th Ave. Estimated cost $10,000.

Calif., San Francisco — American La France Fire Engine Co., 1434 Howard St., awarded contract for the construction of a 1 story assembling plant at 16th and Shotwell Sts. $43,500. Noted Apr. 9.

Calif., San Francisco — H. Lesser, A. Aronson, et al., 58 2nd St., is having plans prepared for the construction of a 5 story garage at Jessie and 4th Sts. Estimated cost $250,000. Ashley & Evers, 58 Sutter St., Archts.

Conn., East Hartford (Hartford P. O.—Economy Grocery Co., 85 South Leonard St., Waterbury, awarded contract for the construction of a 1 story, 55 x 125 ft. garage, 2 story, 50 x 200 ft. office building, etc., on Boulevard St. here. Estimated cost $225,000.

Conn., Hartford—Spencer Turbine Co., New Park Ave., is receiving bids for the construction of a 2 story, 44 x 152 ft. factory and office building on New Park Ave. Estimated cost $150,000. Buck & Sheldon, 60 Prospect St., Archts.

Conn., Stamford—School Comn., C. H. Martin, will soon award contract for the construction of a 2 story school building including manual training rooms on Fairfield Ave. Estimated cost $150,000. Emmens & Abbott, 1 Bank St., Archts.

Md., Baltimore—Pioneer Hardwood Flooring Co., Ashland Ave. and 8th St., awarded contract for the construction of a 120 x 245 ft. plant at Ashland Ave. and 8th St. Estimated cost $50,000. Noted June 25.

Md., Hagerstown—M. P. Moeller Organ Works, awarded contract for the construction of a 3 story, 60 x 140 ft. factory and a 2 story, 40 x 80 ft. office building. Estimated cost $150,000. Noted July 30.

Mass., Boston—Boston Elevated Railway Co., Park Square Bldg., awarded contract for the construction of a 1 story boiler house and repair garage addition. Estimated cost $50,000.

Mass., Boston—T. J. Moynahan Jr. and A. Erlandson, 59 Carver St., awarded contract for the construction of a 2 story, 140 x 290 ft. garage at 210 Albany St. Estimated cost $450,000. Noted July 30.

Mass., Boston—I. S. Stone, 53 State St., is receiving bids for the construction of a 1 story repair and service garage on Magoun Sq. Estimated cost $40,000. F. A. Norcross, 46 Cornhill St., Archt. Noted July 2.

Mass., Chelsea (Boston P. O.)—Gorden & Gerber, 20 Sumner St., is having plans prepared for the construction of a 1 story, 60 x 150 ft. addition to metal working plant. Estimated cost $40,000. S. S. Eisenberg, 46 Cornhill, Boston, Archt.

Mass., Dorchester (Boston P. O.) — H. Klayman, 39 Wilcox St., plans the construction of a 2 story, 90 x 120 ft. repair and service garage on Neponset Ave. Estimated cost $90,000. S. E. Moffie, 51 Cornhill, Boston, Archt. Owner will build by separate contracts.

Mass., Shelbourne Falls—J. M. Blassbury, awarded contract for the construction of a 2 story, 75 x 85 ft. repair and service garage. Estimated cost $50,000.

Mass., Winchester — J. Haggerty, 736 Main St., is receiving bids for the construction of a 2 story garage and repair shop. Estimated cost $40,000. Kennedy & Olmstead, 80 Boylston St., Boston, Archts.

Mass., Worcester—C. D. Parker & Co., 150 Congress St., Boston, is having preliminary plans prepared for the construction of a 2 story garage at Myrtle and Burnside Sts. Estimated cost $160,000. Y. D. Service, Inc., lessee. C. T. Main Co., 200 Devonshire St., Boston, Archt.

Mich., Battle Creek—The Burns Brass Foundry Co., plans the construction of a new foundry unit.

Mich., Bay City—H. Hirschfield Sons Co., awarded contract for the construction of a scrap metal plant.

Mich., Detroit—Dodge Bros., Inc., Jos. Campau Ave., plans the construction of a 6 story, 100 x 462 ft. assembly plant. Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts.

N. Y., Buffalo—The Kittinger Furniture Co., 1893 Elmwood Ave., had plans prepared for the construction of a furniture factory on Elmwood Ave. Estimated cost $40,000.

N. Y., New York—L. J. Monet, c/o E. I. Shire, 373 4th Ave., Archt. & Engr., is having plans prepared for the construction of a 3 story garage at 332 East 76th St. Estimated cost $200,000.

O., Cleveland—Diamond Bronze Co., 5415 Brow Ave., awarded contract for the construction of a 1 story, 60 x 125 ft. plant on Sideway Ave. Estimated cost $40,000.

O., Cleveland—J. H. Shaffrank, 9801 Lake Ave., awarded contract for the construction of a 1 story, 100 x 150 ft. garage at West 117th St. and Clifton Blvd. Estimated cost $150,000.

O., Cleveland — United Brotherhood of Carpenters & Joiners of America, H. Schwarzer, 1355 Central Ave., Secy., is having plans prepared for the construction of a 3 story 90 x 111 ft. garage, at West 38th and Lorain St. $150,000. S. Hovanetz, 9024 Lorain Ave., Archt.

O., Cleveland—Vichek Tool & Supply Co., 3000 East 86th St., awarded contract for the construction of a 1 story, 21 x 70 and 25 x 86 ft. garage and press shop on 86th St. Estimated cost $40,000.

O., East Youngstown—Youngstown Sheet & Tube Co., West Federal St., plans the construction of a tube mill for the manufacture of seamless pipe here. Estimated cost $2,000,000.

O., Youngstown—The Youngstown Foundry & Machine Co., 365 East Boardman St., has had plans prepared for the construction of a 120 x 250 ft. foundry on Poland Ave. Estimated cost $200,000. Private plans.

Okla., Oklahoma City—Buick Motor Co., 504 North Broadway, is having preliminary plans prepared for the construction of a 4 story, 75 x 140 ft. automobile supply building at 10th St. and Broadway. Estimated cost $200,000. Campbell & Price, 603½ West Main St., Archt.

Tex., Dallas—C. P. Collins & Associates, Western Indemnity Bldg., is having preliminary plans prepared for the construction of an 8 story garage at Commerce and Poydras Sts. Estimated cost $200,000. Lang & Witchell, 300 American Exchange Bldg., Archts.

Wis., Baraboo—Sauk County, W. Halbersleben, Comr., awarded contract for the construction of a 1 story, 40 x 100 ft. machine shop. Estimated cost $40,000. Noted July 2.

Wis., Green Bay—Northwest Engineering Works, Howard St., awarded contract for the construction of a 1 story, 80 x 120 and 82 x 100 ft. addition to fabricating and erecting shop.

Wis., Milwaukee — International Harvester Co., 217 Oregon St., awarded contract for the construction of a 1 story, 80 x 120 ft. addition to service building on Reed St. Estimated cost $50,000. Noted July 30.

Wis., Racine—Lakeside Malleable Casting Co., 23rd and Clark Sts., awarded contract for the construction of a 1 story, 83 x 280 ft. foundry. Estimated cost $40,000.

Ont., Baden—J. L. Forler, plans rebuilding saw and planing mills to replace fire loss. Estimated cost $25,000.